INSECTS OF MICRONESIA

Homoptera: Coccoidea[1,2]

By JOHN W. BEARDSLEY, JR.
UNIVERSITY OF HAWAII, HONOLULU, HAWAII

INTRODUCTION

This paper is primarily a systematic treatment of the Micronesian representatives of the homopterous superfamily Coccoidea, a large and important group of phytophagous insects containing many species of economically important pests.

Collectively, the Coccoidea are usually termed "scale insects" as the body is frequently scalelike in form or covered by a scalelike shield. In certain important groups such as the Margarodidae and the Pseudococcidae, however, the body is normally saclike and without a scale covering. For want of a better common name, the term "scale insects" is applied to the superfamily as a whole in this paper.

One hundred forty-five species, representing six families of Coccoidea (Margarodidae, Ortheziidae, Pseudococcidae, Coccidae, Asterolecaniidae, and Diaspididae), are treated here. Of these, 135 species were represented in material available for study, and 10 were recorded previously but not represented in Micronesian collections which I have seen. It is possible that several of the latter may represent earlier misidentifications. Five new genera and 26 new species are proposed in this report.

For the purposes of this study the geographic limits of Micronesia proposed by Gressitt (1954 : 6) have been accepted. By this definition, Micronesia includes the Bonin, Volcano, Mariana, Caroline, Marshall, and Gilbert Island groups, plus a few relatively small outliers such as Wake Atoll, Nauru Island, and Ocean Island. For details of the physical and biotic environment of the various Micronesian islands and island groups see Gressitt (1954).

[1] This represents, in part, Results of Professor T. Esaki's Micronesian Expeditions (1936–1940), No. 127.

[2] Published with the approval of the Director of the Hawaii Agricultural Experiment Station as Technical Paper No. 693.

HISTORICAL BACKGROUND

Very little was known of the Micronesian Coccoidea prior to the Japanese administration of the islands. One important coconut pest, *Furcaspis oceanica*, was described by Lindinger (1909)[3] from material collected at Jaluit, Marshall Islands, and the same species was redescribed and figured by Green (1910) from specimens obtained on Yap. In 1909, S. I. Kuwana published a list of 23 scale insects from the Bonin Islands, including descriptions of seven new species. Several of the latter have been shown to be synonyms of previously described species (Takahashi, 1955). Unfortunately, Kuwana's descriptions, when judged by modern standards, are of inferior quality. As authentic material of one of his species has been unavailable, the status of that species remains in doubt.

Small collections of scale insects were made by various economic entomologists working on Guam, beginning with D. T. Fullaway in 1911, and a few records were published in reports of the Guam Department of Agriculture (Vandenburg 1926–1933).

Following World War I, the Japanese were mandated the former German possessions in Micronesia, giving them control of all the major island groups included within the scope of this study, with the exception of the Gilberts, Guam, and a few outliers such as Wake. During the latter part of the Japanese administration, in the years 1936–1940, Professor T. Esaki made several expeditions to various of the Mariana, Caroline, and Marshall Islands to collect and study economic insects. Dr. R. Takahashi, then with the Imperial College of Agriculture, Taipei, Taiwan, published a series of four papers (1936, 1939, 1941, 1942) dealing with the scale insects, whiteflies, and aphids of the Micronesian islands then under mandate to Japan. These papers were based primarily upon specimens collected by Esaki. In addition to listing previously described forms, Takahashi described 11 new species of Coccoidea from Micronesia. Fortunately, Takahashi's descriptions are of superior caliber, and as type material of most of his species has been available it has been possible to treat all of his species in a satisfactory manner.

Since the end of World War II, a small amount of information concerning Micronesian scale insects has been published, largely in reports of various economic entomologists working in the area (Beardsley, 1955; Oakley, 1946; Townes, 1946). Most of the identifications cited in these papers were made by the late Dr. Harold Morrison of the Agricultural Research Service, U.S. Department of Agriculture, Washington, D.C. Fullaway (1946a) published a list of scale insects known from reports on prewar collections from Guam, but unfortunately the list contains several apparent mis-

[3] Dates in parentheses refer to Literature Cited, p. 559, or to Insects of Micronesia, volume 2, Bibliography.

identifications and a number of incomplete determinations, and is of but limited value.

ACKNOWLEDGEMENTS

I am grateful to many persons and institutions who have assisted in various ways during the course of this study. I am particularly indebted to the late Dr. Harold Morrison, formerly with the U.S. Department of Agriculture, Agricultural Research Service. During the latter part of 1957, I was privileged to spend twelve weeks in Washington, D.C., working under Dr. Morrison's direction on the initial phases of this study. At that time Dr. Morrison was in charge of the U.S. National Coccid Collection, probably the most complete collection of scale insects in existence. Through recourse to this collection and to the nearly complete library of publications dealing with the systematics of the Coccoidea available there, it was possible to identify much of the Micronesian scale insect material then at hand. Subsequently, through correspondence, Dr. Morrison continued to give generously of his time, making comparisons of slides sent him with material in the national collection, and offering helpful comments and opinions, to within a few months of his death in March 1963. I am grateful to the Division of Insect Identification and Parasite Introduction of the U.S. Department of Agriculture, Agricultural Research Service, for the use of their facilities in Washington. Funds for transportation and living expenses while in Washington were made available through a grant from the McInerny Foundation of Honolulu, and I wish to express my sincere appreciation to that institution for making this research possible. I am also indebted to Bernice P. Bishop Museum of Honolulu, particularly to Dr. J. L. Gressitt of the Entomology Department, which sponsored this research and made available for my use a binocular compound microscope. To my former employers, the Experiment Station, Hawaiian Sugar Planters' Association, I am grateful for office, library, and laboratory facilities. To my wife, Lynn, who typed this manuscript, I am especially grateful.

I am indebted for assistance in clearing up various points concerning the identity of several species which has been received from Professor Howard McKenzie, University of California, Davis; Dr. D. J. Williams, Commonwealth Institute of Entomology, London; and Dr. Sadao Takagi of Hokkaido University, Sapporo, Japan. Miss Louise M. Russell, U.S. Department of Agriculture, Agricultural Research Service in Washington, D.C., made determinations of many specimens of Asterolecaniidae before I took over the work on the Micronesian scale insects in 1957, and she subsequently assisted in clearing up certain problems involving this group. I wish also to express my thanks to Mr. B. McDaniel of the Texas College of Arts and Industries, who generously allowed me to include his valuable collection of scale insects from Yap and Palau Islands in this study.

The United States Office of Naval Research, the Pacific Science Board (National Research Council), the National Science Foundation, and Bernice P. Bishop Museum have made this survey and publication of the results possible. Field research was aided by a contract between the Office of Naval Research, Department of the Navy, and the National Academy of Sciences, NR 160-175.

MATERIALS AND METHODS

Collections Examined

Approximately 1700 slides, bearing about 5,000 individual specimens of Coccoidea from Micronesia, were examined during this study. The specimens were derived from several sources and represent the efforts of numerous collectors. The four largest collections were: (1) those of Henry Townes and R. G. Oakley, made in 1946, under the auspices of the U.S. Commercial Company (a U.S. owned corporation set up to deal with post-war trade and agricultural problems in the Pacific); (2) those made by several entomologists (P. A. Adams, J. F. G. Clarke, H. S. Dybas, R. J. Goss, J. L. Gressitt, N. L. H. Krauss, Ira La Rivers, R. W. L. Potts, R. L. Usinger, and possibly others) who worked for the Bishop Museum Micronesian Insect Survey (1948–1954), financed by the Office of Naval Research through the Pacific Science Board; (3) survey collections made by entomologists of the U.S. Department of Agriculture, Division of Plant Quarantine (K. L. Maehler and M. M. Ross), during 1947–1949; and (4) collections by entomologists employed by the U.S. Trust Territory of the Pacific Islands under the U.S. Department of Interior during 1949–1958 (J. W. Beardsley, D. B. Langford, R. P. Owen, and N. Tellei).

A smaller but valuable collection was made by B. McDaniel in Palau and Yap during 1956, under the auspices of the George Vanderbilt Foundation.

Other lots of specimens of particular importance include a portion of Kuwana's unmounted material from the Bonin Islands, obtained from Kyushu University; slides and unmounted material collected by T. Esaki during 1936–1940, including types of Takahashi's Micronesian species, loaned by the Taiwan Agricultural Research Institute, Taipei, Taiwan; and slides from the U.S. National Coccid Collection and from the State Department of Agriculture, Hawaii, representing a portion of the prewar Guam collections of D. T. Fullaway, R. G. Oakley, O. H. Swezey, R. L. Usinger and others. Several additional collections of limited geographic scope have been received during the past several years from various entomologists employed by the U.S. Navy, the Government of Guam, and the U.S. Public Health Service and others (E. S. Brown, C. F. Clagg, W. W. Cantelo, E. J. Ford, Jr., C. R. Joyce, N. L. H. Krauss, A. A. La Plante, and W. C. Mitchell).

The collections from the various islands and island groups are not equally representative, as relatively very little material has been available from certain areas included within the scope of this study. The Bonin and Volcano Islands, unfortunately, are very poorly represented, as are the Northern Mariana Islands. No material whatsoever is available from the outliers Marcus Island and Nauru Island, or from several of the atolls, mostly uninhabited, in the Caroline and Marshall Islands. Kusaie collections are disappointing in that only a single species peculiar to that island is included. Only three atolls are represented in the collections of E. S. Brown and N. L. H. Krauss from the Gilbert Islands.

Method of Study

This study is based almost entirely upon slide-mounted specimens of adult females. Limiting the treatment largely to slide preparations is justified for several reasons. Firstly, the diagnostic characters employed in modern systematic studies of the Coccoidea are nearly all of such a minute character that carefully made microscope preparations are necessary for their proper evaluation. Secondly, a sizable portion of the material studied was already mounted on slides when received, and most of the material available in an unmounted condition was preserved in alcohol, which often alters the color and form of the external secretory products which frequently cover the living insects. I have not seen *in situ* material of several of the species treated here. References to external characters, such as shape and color of scale coverings, or wax tests, are intended only to supplement the use of proper slide preparations, as such features as scale coverings and wax secretions often appear nearly identical in two or more quite distinct species.

The limiting of systematic treatments to the last instar females (often referred to both here and elsewhere as the "adult female" although these insects appear to be neotenic in the female sex) has been a practice followed by many recent students of the Coccoidea. Although immature stages and adult males have been shown to possess characters of definite taxonomic value in some groups such as the Margarodidae (Morrison, 1928), the Asterolecaniidae (Russell, 1941), and the Pseudococcidae (Beardsley, 1960), it has been necessary to limit this study to mature females as, for the majority of the species treated, satisfactory material of other stages has not been available.

Of the approximately 1700 slide preparations examined, nearly 1,000 were made available from the U.S. National Coccid Collection and from various other sources. The remaining 700 or so slide mounts were prepared from material in alcohol which had been collected by me during 1952–1954, and by various other persons during the years since 1954. For certain

critical comparisons it was also necessary in a number of instances to remove and restain previously mounted specimens which had faded badly.

Drawings

I have attempted to illustrate adequately all of the new species described in this paper. The Coccoidea lend themselves well to this type of graphic presentation as, when mounted on slides, they are reduced essentially to parallel dorsal and ventral surfaces. Balachowsky, Ferris, McKenzie, Williams, and others have emphasized the use of semidiagrammatic drawings as a satisfactory and convenient way to present descriptive data on species of scale insects. The type of presentation popularized by Ferris in his monumental Atlas of the Scale Insects of North America (1937–1955) has been largely adopted here. The figures were executed with aid of a squared ocular reticule and are semidiagrammatic in that nonstructural irregularities of shape due to accidents in mounting, and other causes, have been ignored, appendages have been drawn in more or less standardized positions, and, where necessary for proper illustration of salient morphological characters, more than one specimen has been utilized in preparing a drawing of a given species. In certain groups, particularly the Pseudococcidae, it has been necessary to exaggerate the sizes of certain dermal structures (pores and ducts) in drawings of the whole insects to compensate for reduction of figures to page size. The drawings should be considered an essential part of the description of each new species.

Drawings of certain previously described species are also included. Two of these are type species of new genera proposed here; the others are either inadequately illustrated elsewhere, or serve to clarify certain structural differences between closely similar forms, or are of species described elsewhere during the time this paper was in preparation.

Citation of Collection Data and Literature

Host records cited with collection data have been taken directly from specimen labels. Except for corrections of obvious errors in spelling, these are cited as given and, without information to the contrary, host determinations are assumed to represent the opinion of the collector alone.

In citing collection localities I have adhered to spellings used in the gazetteer of Micronesian localities presented by Gressitt (1954) in the Introduction to the Insects of Micronesia series. Minor differences in spelling have been corrected to agree with Gressitt's interpretation without further note. Where the name used by the collector and that accepted as correct by Gressitt differ markedly, the former is given in parentheses following the latter.

The following abbreviations have been used to denote institutions where type specimens are deposited: BISHOP (B. P. Bishop Museum), BM (British Museum), UH (University of Hawaii), US (United States National Museum).

The citations of literature references to genera and species have been largely limited to original descriptions, references to synonyms, homonyms, and misidentifications recorded from Micronesia, and to the most important redescriptions, particularly those where species have been adequately figured. For many of the widespread pestiferous species which occur in Micronesia, an attempt to cite all recorded synonymy and literature references would be extremely laborious and of relatively little value, as much of the work would be merely a recapitulation of information already available in the Fernald Catalog (1903), its supplements (Sanders, 1906 and 1909; Sasscer, 1911, 1912, 1915) and elsewhere.

ZOOGEOGRAPHY

From the viewpoint of zoogeography, the Coccoidea are a difficult group. Most of the species common on cultivated plants became widely distributed on food and propagative material before plant quarantines restricted the movement of such material. Many species are continuing to spread into previously uninfested areas, although less rapidly, in spite of quarantine regulations. Several instances of spread of economically important species within Micronesia, with serious consequences to local agriculture, have been recorded during the past thirty years or so. The small size and cryptic habits of scale insects in general make their presence difficult to detect, particularly when but a few individuals are present. Parthenogenetic or hermaphroditic reproduction is characteristic of a number of widespread pest species, and in such cases a single individual inadvertently transported to a new area on a bit of vegetation is potentially capable of giving rise, within a few months, to a flourishing infestation.

Thorough revisionary studies have been made of a few genera of scale insects which contain widespread pest species, such as those on *Aonidiella* (McKenzie, 1938), *Aspidiotus* (Ferris, 1941a), and *Chrysomphalus* (McKenzie, 1939). In such groups the existence of concentrations of species within certain geographic areas provide some indication of the general region of origin. In a few other groups, such as *Aulacaspis*, *Icerya*, and *Lepidosaphes*, which are less thoroughly known, enough information is available to permit some tentative conclusions concerning origin. However, many of the important genera of Coccoidea are as yet rather poorly understood and not very clearly defined, for example, *Pseudococcus*, *Dysmicoccus*, *Trionymus*, *Coccus*, and *Pulvinaria*. Numerous species from widely scattered geographic areas have been assigned to such groups, and although at times it is possible

to make an educated guess concerning the geographical area of origin of a particular species, in many cases even this is not feasible.

The distributions of the known Micronesian scale insects are summarized in Table 1. The term "widespread," which appears frequently, indicates that the species is known, outside of Micronesia, from a number of localities in both the Eastern and Western Hemispheres. A question mark in any given locality column indicates a literature record of the species from that area, although no specimens were included in material which I studied. The letter "q" denotes that the species is known from the area only from quarantine interceptions made elsewhere, usually outside of Micronesia, which are labeled as originating from the area indicated. From this table and from what is known about the probable origins of genera such as *Aonidiella*, *Aspidiotus*, *Aulacaspis*, *Chrysomphalus*, *Icerya*, and *Lepidosaphes*, it is evident that the Micronesian scale insect fauna has its strongest affinities with the Oriental and Australian major zoogeographical realms. Four species are known, outside of Micronesia, only from New Guinea and (or) the Solomon Islands; four species from the Philippines only; one from Fiji and Polynesia only; one from Fiji and the Solomons only; and one from Taiwan only. About 37 more widely dispersed species are either restricted to the Australian, Oriental, and eastern Palaearctic Regions, or if widely distributed, apparently are of Old World origin.

Eight of the species known from outside Micronesia appear to be Neotropical in origin. Their presence in Micronesia probably is due to the importation of plant material from the Americas which perhaps began at the time of the Spanish explorers, about 400 years ago. The species are *Dysmicoccus brevipes* (Cockerell), *D. neobrevipes* Beardsley, *Phenacoccus solani* Ferris, *Ceroplastes cirripediformis* Comstock, *Pulvinaria urbicola* Cockerell, *Diaspis boisduvalii* Signoret, *D. bromeliae* (Kerner), and *Melanaspis bromeliae* (Leonardi). It is of interest that five of these species have been taken in Micronesia or elsewhere on pineapple, a plant of Neotropical origin. One new species of mealybug described in this paper, *Pseudococcus neomaritimus*, also appears to be of Neotropical origin, although it is as yet not known outside of Micronesia. *Phenacoccus solani* and *Ceroplastes cirripediformis* are almost certainly recent introductions which became established in Micronesia during or following World War II. Both are confined to the easternmost portion of Micronesia as yet.

Five genera and 37 species of Coccoidea are now known only from Micronesia. Some may be endemic to the area, while others may eventually be found in adjacent areas of the Pacific. So imperfect is our knowledge of the scale insect faunas of New Guinea, the Philippines, the Solomons and other South Pacific islands or island groups that it would be useless to speculate further as to the probable zoogeographic affinities of these forms.

TABLE 1.—Distribution of Micronesian Coccoidea

	Micronesian Island Groups													Other Localities
					Caroline									
	Bonin	Volcano	N. Mariana	S. Mariana	Palau	Yap	Caroline Atolls	Truk	Ponape	Kusaie	Wake	Marshall	Gilbert	
MARGARODIDAE														
1. Drosicha littorea*					×		×							
2. Crypticerya jacobsoni				?	?	?								Philippines, Java, India, Burma
3. Icerya aegyptiaca			×	×	×	×	×	×	×		×	×	×	Old World tropics
4. I. purchasi				G†							×	×	×	Widespread, Hawaii
5. I. seychellarum					?	×	×							Old World tropics, Tahiti, Samoa, Ocean I.
6. Steatococcus samaraius					×	×								New Guinea, Solomon Is.
ORTHEZIIDAE														
7. Nipponorthezia guadalcanalia					×	×		×		×				Solomon Is., Hawaii
PSEUDOCOCCIDAE														
8. Antonina graminis				×	×			×			×	×		Widespread, Hawaii, Johnston Island
9. Chaetococcus bambusae				S†	×	×								Oriental and Ethiopian regions, Hawaii
10. Dysmicoccus boninsis	?			×	×		×	×	×					Widespread, Hawaii
11. D. brevipes	?			×	×	×		×	×			×	?	Widespread, Hawaii
12. D. neobrevipes				×									×	Jamaica, Mexico, Hawaii, Philippines (?), Fiji
13. D. saipanensis			×	×		×	×	×	×	×		×		
14. D. wistariae													×	Japan, N. America, England
15. Ferrisia virgata			?	×	×	×		×	×		×	×	×	Widespread, Hawaii
16. Geococcus coffeae					?			×		×				Widespread, Hawaii
17. Laminicoccus pandani							×	×	×			×	×	Tahiti, Fiji, Marquesas Is., Hawaii
18. L. sp.					×									
19. Neoripersia ogasawarensis	×													
20. Neosimmondsia esakii									×					

* Described as new.
† G=Guam only; S=Saipan only.

TABLE 1.—Distribution of Micronesian Coccoidea

	Micronesian Island Groups													Other Localities
					Caroline									
	Bonin	Volcano	N. Mariana	S. Mariana	Palau	Yap	Caroline Atolls	Truk	Ponape	Kusaie	Wake	Marshall	Gilbert	
21. Palaucoccus* gressitti*					×									
22. Palmicultor guamensis*				G										
23. P. palmarum					×	×	×	×	×	×		×	×	Malaya, Philippines (?), Hawaii, Canton I.
24. Pandanicola* esakii					×									
25. P. pandani									×					
26. Paraputo leveri							T†							Solomon Is. Fiji, New Guinea
27. Phenacoccus solani												×	×	Puerto Rico, continental U.S., Hawaii
28. Planococcus citri				×	×	×	×	×	×	×		×	×	Widespread, Hawaii
29. P. lilacinus				G			×							Madagascar, Mauritius, India, Ceylon, Java, Philippines
30. Pseudococcus adonidum								?						Widespread, Hawaii
31. P. casuarinae					×									
32. P. citriculus					×				×					Ceylon, Hawaii
33. P. comstocki				?					?					Japan, Continental U.S.
34. P. dybasi*					×									
35. P. gilbertensis*													×	
36. P. kusaiensis*										×				
37. P. macrocirculus*					×	×	×							
38. P. marshallensis*										×		×		
39. P. microadonidum*								×	×			×	×	
40. P. multiductus*					×									
41. P. neomaritimus*				×		×		×						
42. P. orchidicola				×			×	×		×		×	×	
43. P. pandanicola					×									
44. P. solomonensis					×	×		×	×					Solomon Is.
45. P. trukensis*							×	×	×					
46. P. yapensis*						×								
47. Rhizoecus advenus*								×						Hawaii
48. R. carolinensis*								×		×				
49. Saccharicoccus sacchari				×	×	×	×	×	×					Widespread, Hawaii
50. Trionymus palauensis*					×									New Guinea
51. T. townesi*				T††										
52. Turbinococcus* pandanicola					×									

† T=Tobi Island only.
†† T=Tinian only.

TABLE 1.—Distribution of Micronesian Coccoidea

	Micronesian Island Groups													Other Localities
					Caroline									
	Bonin	Volcano	N. Mariana	S. Mariana	Palau	Yap	Caroline Atolls	Truk	Ponape	Kusaie	Wake	Marshall	Gilbert	
COCCIDAE														
53. Ceroplastes cirripediformis											×	×		West Indies, southern U.S., Mexico, Hawaii
54. C. floridensis	?			?G	×									Widespread
55. C. pseudoceriferus					×									Japan, India, Ceylon
56. C. rubens				×	×									Widespread, Hawaii
57. Coccus acuminatus				×	×									Widespread, Hawaii
58. C. elongatus	×			×	×		×					×	?	Widespread, Hawaii
59. C. hesperidum				×	×	q	×	?				×		Widespread, Hawaii
60. C. mangiferae					×									Widespread, Hawaii
61. C. moestus				G	×		×	×						Africa
62. C. viridis				×	×	×		×	×					Widespread, Hawaii
63. Eucalymnatus tessellatus				?S	×			×	×	×				Widespread, Hawaii
64. Paralecanium carolinensis*							×	×						
65. Pulvinaria aurantii	?													Japan
66. P. psidii	×	×		×	×			×	×	×		×		Widespread, Hawaii
67. P. thespesiae?								×						Ceylon
68. P. urbicola				×			×							Jamaica, Barbados, Trinidad, Hawaii
69. Saissetia coffeae	?		?	×	×	×		?	?			×		Widespread, Hawaii
70. S. nigra	×	×	?	×	×	×		×		×			×	Widespread, Hawaii
71. S. oleae			?	×	×			×				×		Widespread, Hawaii
72. Vinsonia stellifera					×				×					Widespread
ASTEROLECANIIDAE														
73. Asterolecanium bambusae				×	×									Widespread, Hawaii
74. A. coronatum					×									Ceylon, Taiwan
75. A. miliaris				×	×				×					Widespread, Hawaii
76. A. pseudo-lanceolatum									?					Taiwan
77. A. pseudomiliaris				×	?				×					Widespread
78. A. pustulans				G	×			×				×		Widespread, Hawaii
79. A. robustum				G	×				×					Widespread
80. A. sp.							?W†							
DIASPIDIDAE														
81. Africonidia macdanieli*					×									
82. Anastomoderma* palauensis*					×									
83. Aonidiella aurantii	?			?	?			?				?		Widespread
84. A. comperei				×	×	×	×	×				×		India, Australia (?)

† W=Woleai only.

TABLE 1.—Distribution of Micronesian Coccoidea

	Micronesian Island Groups													Other Localities
					Caroline									
	Bonin	Volcano	N. Mariana	S. Mariana	Palau	Yap	Caroline Atolls	Truk	Ponape	Kusaie	Wake	Marshall	Gilbert	
85. A. eremocitri					×									Australia
86. A. inornata				G	×	×	×	×	×	×	×	×		Philippines, Hong Kong, Hawaii
87. A. orientalis				×		×								Widespread
88. Aspidiella hartii				?G										West Indies
89. A. sacchari				×	×							×		West Indies, S. America, Florida, Ceylon
90. Aspidiotus destructor				×	×	×	?	×	×					Widespread
91. A. excisus				×	×	?	×							Ceylon, Fiji, Formosa
92. A. spinosus						×								Widespread, Hawaii
93. Chrysomphalus dictyospermi	×			×	×			×				×		Widespread, Hawaii
94. C. ficus	?								×					Widespread, Hawaii
95. Duplaspidiotus claviger				G										Widespread, Hawaii
96. D. tesseratus				?G										Widespread, Hawaii
97. Furcaspis oceanica				S	×	×	×	×	×	×		×		
98. Hemiberlesia cyanophylli												×		Widespread, Hawaii
99. H. lataniae	×	×	?	×	×	×		×	×	q	×	×		Widespread, Hawaii
100. H. palmae				S q	×	×		?	×	×		?		Widespread
101. H. rapax	?													Widespread, Hawaii
102. Melanaspis bromeliae				G					×					Widespread, Hawaii
103. Octaspidiotus araucariae									×					New Caledonia, Hawaii
104. Pseudaonidia manilensis					×									Philippines
105. Semelaspidus mangiferae					×									Philippines
106. Odonaspis morrisoni*						×		×						Philippines
107. O. penicillata					×									Widespread, Hawaii
108. O. saccharicaulis					×									Java, India, Philippines, Cuba
109. O. secreta	?													Japan, U.S.
110. Andaspis punicae				G	×									Africa, Hawaii (?)
111. Aulacaspis madiunensis					×									Africa, Java, Queensland, Taiwan, China (?)
112. A. rosae	×													Widespread, Hawaii
113. A. tegalensis						×								Java, Taiwan, Philippines, Mauritius

TABLE 1.—Distribution of Micronesian Coccoidea

	Micronesian Island Groups													Other Localities
					Caroline									
	Bonin	Volcano	N. Mariana	S. Mariana	Palau	Yap	Caroline Atolls	Truk	Ponape	Kusaie	Wake	Marshall	Gilbert	
114. Diaspis boisduvalii					×				×					Widespread, Hawaii
115. D. bromeliae									×					Widespread, Hawaii
116. Fiorinia fioriniae	?													Widespread, Hawaii
117. F. nephelii				?S										China, Taiwan, Queensland, Hawaii
118. F. japonica?	×													Japan, Taiwan, Philippines
119. Howardia biclavis	×				×			?						Widespread, Hawaii
120. Ischnaspis longirostris	×			×	×									Widespread, Hawaii
121. Lepidosaphes arii	×													
122. L. beckii				G				?	×			q		Widespread, Hawaii
123. L. bladhiae?				×	×	×			×		×			Formosa, Philippines
124. L. carolinensis*					×	×								
125. L. esakii			×	×			×	×	×	×		×		
126. L. gloverii	×			S				×	×					Widespread, Hawaii
127. L. micronesiensis									×					
128. L. palauensis*					×									
129. L. spinulosa*				G	×									
130. L. tokionis				×	×	×		?						Widespread, Hawaii
131. L. ulapa*					×									
132. Palauaspis* multiductus*					×									
133. Parlatoria cinerea				×										Widespread
134. P. crotonis					×			×						Widespread, Hawaii
135. P. pergandii	×							×	?					Widespread, Hawaii
136. P. proteus	?			G	×	×	×	×	×	×				Widespread, Hawaii
137. P. zizyphus					×				×					Widespread, Hawaii
138. Phenacaspis cockerelli	×													Widespread, Hawaii
139. P. inday				?G	×	?								Philippines
140. Pinnaspis aspidistrae					×				?					Widespread, Hawaii
141. P. buxi				G					×					Widespread, Hawaii
142. P. strachani				×	×	×	×	×	?		×	×	×	Widespread, Hawaii
143. Pseudaulacaspis pentagona				×	×		×	×						Widespread
144. Radionaspis indica					×									India, Florida, Puerto Rico, Hawaii
145. Unaspis citri									×					Widespread

HOST RECORDS

From the host records which accompany the Micronesian collections, it is evident that the greatest emphasis has been placed upon collecting Coccoidea associated with crop plants, cultivated ornamentals, and widespread weeds. Several of the species which occur in Micronesia have been responsible for serious damage to crop plants on one or more islands. Such pest species include *Icerya aegyptiaca*, *I. purchasi*, and *I. seychellarum* (Beardsley, 1955), and *Aspidiotus destructor* and *Furcaspis oceanica* (Gressitt, 1954: 177–178). Recent unpublished reports from entomologists working in the area indicate that several additional species may be becoming increasingly important (for example, *Pseudaulacaspis pentagona* on cassava). Since many collectors of scale insects in Micronesia have been concerned primarily with economic entomology it is understandable that the bulk of the material at hand is from cultivated plants. For the convenience of those concerned with the control of crop pests, I have listed in Table 2 some of the more important agricultural plants grown in Micronesia with the scale insects which have been found associated with them. A "T" in any column of the table indicates that the species was reported by Takahashi (1936–1942) but is not represented from that host in material at hand.

Several interesting new species of scales described here are from among the relatively small number of samples from uncultivated plants native to Micronesia. Without doubt, many more such new species await discovery. Much additional collecting, with particular attention to the native flora, remains to be done in Micronesia as well as in surrounding areas of the Pacific if we are ever to achieve a clear idea of the nature and extent of the scale insect faunas endemic to these areas. In this regard it is of interest that *Pandanus*, various species and varieties of which are native to Micronesia as well as being of economic importance, has in this region a known scale insect fauna of 16 species, of which 11 are not yet known outside the area.

SYSTEMATICS

KEY TO FAMILIES OF COCCOIDEA KNOWN FROM MICRONESIA
(in part after Zimmerman, 1948)

ADULT FEMALES

1. Two or more pairs of abdominal spiracles present..... 2
   Abdominal spiracles absent..... 3
2. Anal ring well developed, with a band of small cells on each side and bearing six setae.....**Ortheziidae**
   Without such a cellular, setigerous anal ring.....**Margarodidae**

3. Anal opening covered dorsally by a pair of sclerotized plates which form an operculum.....**Coccidae**
   Anal opening without such an operculum..... 4
4. Lateral margins of body with row or band of 8-shaped (geminate) wax pores.....**Asterolecaniidae**
   Without such marginal geminate pores..... 5
5. Posterior abdominal segments fused into a sclerotized pygidium; without a cellular or setigerous anal ring; normally enclosed within a thin scale formed from nymphal exuviae incorporated with wax.....**Diaspididae**
   Posterior abdominal segments not fused into a sclerotized pygidium; anal ring cellular and setigerous; not enclosed within such a scale.....**Pseudococcidae**

The sequence of presentation of the families of Micronesian Coccoidea employed here reflects currently accepted views on the phylogenetic relationships within the superfamily. The more primitive Margarodidae and Ortheziidae are considered first, followed by the "lecanoid" families Pseudococcidae, Coccidae, and Asterolecaniidae, and ending with the more highly specialized Diaspididae. This sequence is based upon cytogenetic as well as morphological evidence. For recent discussions of scale insect phylogeny see Brown (1959) and Brown and McKenzie (1962). Within each family, genera and species are arranged alphabetically, except in the Diaspididae, where the Diaspidinae, the only subfamily represented, is first subdivided into three relatively well defined and widely accepted tribes.

Family MARGARODIDAE

Available Micronesian material contains specimens of five species of Margarodidae, subfamily Monophlebinae Maskell. Three are widely distributed species of *Icerya* Signoret which produced infestations of economic importance in Micronesia, as elsewhere, until controlled by the introduction and spread of coccinellid beetles of the genus *Rodolia* (Beardsley, 1955).

For a thorough treatment of morphology and systematics of this important group of relatively primitive Coccoidea, see Morrison (1928).

Key to Tribes and Genera of known Micronesian Monophlebinae

ADULT FEMALES

1. With 7 pairs of abdominal spiracles; ventral abdominal band of ovisac-forming pores absent; antennae 8- or possibly 9-segmented; Drosichini.....**Drosicha**
   With not more than 4 pairs of abdominal spiracles (3 pairs in known Micronesian forms); antennae normally 10- or 11-segmented; Iceryini..... 2
2. With a distinct band of ovisac-forming pores on venter of abdomen..... 3
   Without such a ventral band of ovisac-forming pores.....**Crypticerya**
3. Mature female with a definite invaginated, pouchlike marsupium; without a definite ovisac extending behind.....**Steatococcus**
   Without such an internal marsupium; mature female forming a definite ovisac...**Icerya**

TABLE 2.—Micronesian Scale Insect Records
From Plants of Economic Importance

Species of Scale Insect (in order of treatment in text)	Host Plant												
	Banana	Breadfruit	Cacao	Cassava	Citrus	Coconut	Coffee	Mango	Pandanus*	Papaya	Pineapple	Sugar Cane	Taro**
MARGARODIDAE													
Icerya aegyptiaca	×	×			×	×							×
I. purchasi					×								
I. seychellarum		×			×	×							
Steatococcus samaraius	×					×							×
PSEUDOCOCCIDAE													
Dysmicoccus boninsis												×	
D. brevipes						×	×		×		×	×	
D. neobrevipes	×		×										
D. saipanensis						×							
D. wistariae		×											
Ferrisia virgata		×		T	×	×	T	×			×		×
Laminicoccus pandani									×				
L. sp.									×				
Neosimmondsia esakii									×				
Palmiculator guamensis						×							
P. palmarum						×							
Pandanicola esakii									×				
P. pandani									×				
Paraputo leveri						×							
Planococcus citri		×	×		×		×						
P. lilacinus		×			×								×
Pseudococcus citriculus					×								
P. macrocirculus													×
P. marshallensis		×											
P. microadonidum	×					×			×				
P. orchidicola	×								×				×
P. pandanicola									×				
P. solomonensis													×
P. trukensis		×			×								
Saccharicoccus sacchari												×	
Turbinococcus pandani									×				
COCCIDAE													
Ceroplastes floridensis								T					
C. rubens						×		×					
Coccus acuminatus								T					
C. elongatus					T	×				T			
C. hesperidum	×	×			×	×							×
C. mangiferae								×					
C. moestus		×						×					
C. viridis					×		×						
Eucalymnatus tesselatus						×	T	T					
Paralecanium carolinensis									×				
Pulvinaria psidii							×						

* Several species and varieties of *Pandanus* occur in Micronesia, but not all can be considered as cultivated plants.

** Includes giant taros such as *Cyrtosperma* spp. and *Alocasia* spp. as well as *Colocasia esculenta.*

TABLE 2.—Micronesian Scale Insect Records
From Plants of Economic Importance

Species of Scale Insect	Host Plant												
	Banana	Breadfruit	Cacao	Cassava	Citrus	Coconut	Coffee	Mango	Pandanus*	Papaya	Pineapple	Sugar Cane	Taro**
Saissetia coffeae					×		×						
S. nigra				×	×	×	×		×				
S. oleae					×								
Vinsonia stellifera						×		×					
ASTEROLECANIIDAE													
Asterolecanium pustulans		×											
A. sp.		×											
DIASPIDIDAE													
Aonidiella aurantii					T								
A. comperei						×				×			
A. eremocitri						×							
A. inornata	×	×			×	×							
Aspidiella sacchari												×	
Aspidiotus destructor	×	×				×		×		×			
A. excisus	×	×			×	T				×			
A. spinosus								×					
Chrysomphalus dictyospermi					×			×					
C. ficus					×								
Furcaspis oceanica						×			×				
Hemiberlesia cyanophylii		×											
Hemiberlesia lataniae		×			×	×		×					
H. palmae		×			×	×		×					
Melanaspis bromeliae											×		×
Semelaspidus mangiferae								×					
Odonaspis saccharicaulis												×	
Andaspis punicae		×											
Aulacaspis madiunensis												×	
A. tegalensis												×	
Diaspis bromeliae											×		
D. boisduvali											×		
Ischnaspis longirostris						×	×	×	×				
Lepidosaphes beckii					×								
L. bladhiae		×			×	×							
L. carolinensis													×
L. esakii						×			×				
L. gloveri					×								
Parlatoria cinerea					×								
P. pergandi					×								
P. proteus					×	×		×					
P. zizyphus					×								
Phenacaspis inday								×					
Pinnaspis buxi									×				
P. strachani						×							
Pseudaulacaspis pentagona		×		×									
Radionaspis indica								×					
Unaspis citri					×								

TRIBE DROSICHINI

Genus **Drosicha** Walker

Drosicha Walker, 1858, List Homopt. Ins. Coll. Brit. Mus. pt. 4, suppl.: 306.—Morrison, 1928, U.S. Dept. Agric. Tech. Bull. **52**: 163.

Warajicoccus Kuwana, 1922, [Japan] Dept. Agric. and Com. Imp. Plant Quar. Sta., Bull. **1**: 7.

Type of genus: *Drosicha contrahens* Walker.

1. **Drosicha littorea** Beardsley, n. sp. (fig. 1).

Adult female (fig. 1, *a*): Length of slide-mounted specimen about 7.0 mm. Body roughly oval, about 4.0 mm. maximum width in type. Antennae 8-segmented, about 1.1 mm. over-all length; segment 8 longest, about 225 μ in length; basal segment short and very broad, about 120 μ long by about 280 μ wide. Antennae moderately densely clothed with slender setae about 160 μ maximum length; apical segment bearing 2 curved thicker digitiform setae 65–75 μ long. Legs moderately large and stout; hind femora about 600 μ long by about 300 μ maximum width; hind tibiae about 700 μ long. Hind tarsal claw about 120 μ long, ungual digitules acute, not attaining apex of claw. Legs moderately densely clothed with rather short setae, mostly 90 μ or less in length. Rostrum 3-segmented, about 480 μ long. Eyes well developed, strongly sclerotized, about 120 μ diameter. Anal opening dorsal, situated at anterior apex of an equilateral triangle formed with the two posterior abdominal spiracles; about 110 μ wide, simple, apparently with a very narrow sclerotized rim at or just within orifice. Thoracic spiracles large, with a slight concentration of 7 to 12 disc pores on ventral derm near orifice, but these absent within tube. Abdominal spiracles about 30–35 μ diameter at orifice, anterior pairs slightly wider than posterior pairs; simple, with 1 or 2 disc pores on margin of orifice; situated on dorsal aspect, a short distance mesad of the marginal band of very long setae, in the only available specimen. Vulvar opening somewhat invaginated in available specimen; apparently with 3 oval ventral cicatrices on posterior margin of vulva, the median cicatrix largest, about 90 μ long, lateral cicatrices mostly obscured in available specimen.

Dorsum and venter of body densely clothed with simple, usually somewhat curved, slender setae; dorsal setae mostly 30–60 μ long, a few longer setae, up to about 120 μ maximum length, and borne on small conical tubercles evenly scattered among the smaller setae. Margin of body with a sparse, sometimes interrupted fringe of much longer setae, mostly 250–400 μ long. Setae of venter slightly longer than on dorsum, mostly 40–90 μ in length, with scattered longer setae up to about 190 μ maximum length. Simple circular or subquadrangular disc pores, 7–9 μ diameter, each with 4 to 7 peripheral loculi, moderately sparsely scattered over dorsum and venter.

Third instar female: Similar in shape to adult female, maximum length about 7 mm. Appendages somewhat smaller than adult; antennae 7-segmented, 0.90–0.95 mm. long; hind femora about 550 μ long by 290 μ maximum width, hind tibiae about 660 μ long. Body setae similar to those of adult; shorter dorsal setae about 25–40 μ long; longer dorsal setae about 105 μ maximum length, shorter ventral setae 30–75 μ long; longer ventral setae about 150 μ maximum, long marginal fringe setae about 380 μ maximum length. Venter of abdomen with 3 well-defined oval cicatrices (fig. 1, *b*).

Male: Unknown.

Holotype, adult female (US 67966), Ulithi, Asor I., Caroline Atolls, Oct. 6, 1952, Krauss, on *Scaevola*. Palau Is., Ngaiangl (Kayangel), Aug. 1956, McDaniel, on "rirs"; Koror, limestone ridge, Nov. 1947, Dybas, beating vegetation. Caroline Atolls: Ulithi, Asor I., Oct. 1952, Krauss, on *Scaevola*;

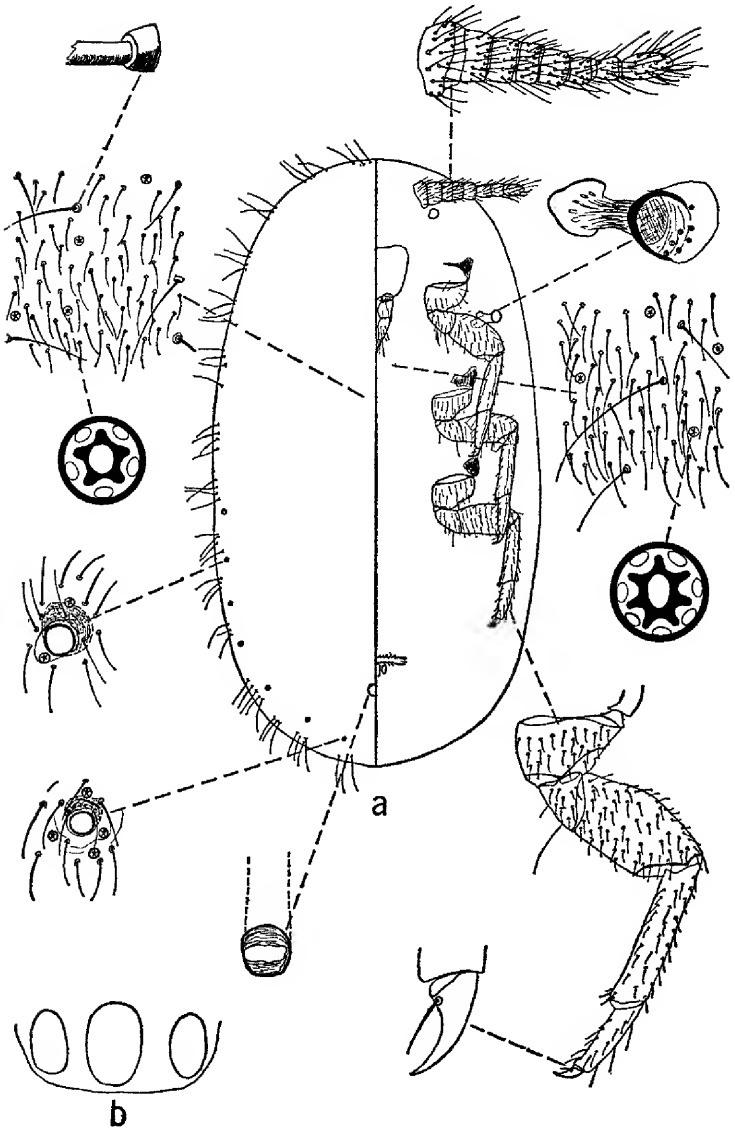

FIGURE 1.—*Drosicha littorea*: **a**, adult female, dorsal and ventral aspects (body setae and pores omitted) and details; **b**, third instar female, ventral abdominal cicatrices.

Ngulu, Ngulu I., Oct. 1952, Krauss, on *Scaevola*; Sorol, Sorol I., Oct. 1952, Krauss, on *Scaevola*; Satawal, Sept. 1952, Krauss, on *Messerschmidia* (*Tournefortia*).

DISTRIBUTION: Caroline Is. (Palau, Caroline Atolls).

HOSTS: *Scaevola*, *Messerschmidia*. These are common strand shrubs found throughout Micronesia. That it has been collected only on these hosts suggests that *D. littorea* may be confined largely to strand areas.

The holotype specimen, the only adult female available, has been compared with adult specimens of the following species in the U.S. National Coccid Collection in Washington, D.C.: *D. contrahens* (Walker)? from China; *D. corpulenta* (Kuwana), *D. howardi* (Kuwana), and *D. pinicola* (Kuwana) from Japan; *D. townsendi* (Cockerell) from the Philippines; *D. stebbingii* (Stebbing), *D. dalbergiae* (Stebbing) and *D. mangiferae* (Green) from India. *D. littorea* differs from all the above in having shorter, smaller appendages. The Indian species are much larger, with the hind tibiae measuring 1.3 to 1.4 mm. in length, vs. 0.7 mm. in *littorea*. *D. contrahens*? specimens from China have hind tibiae about 1.0 mm. in length, and differ also in that the body setae are relatively uniform in size on both dorsum and venter; the dorsal setae measuring 52 to 62 μ long and ventral setae 64 to 87 μ long. The smallest setae of both surfaces are considerably longer than those of *D. littorea*, and the latter species possesses conspicuously longer setae scattered on both dorsum and venter. The Philippine and Japanese species have appendages slightly to considerably longer than those of *D. littorea* (the hind tibiae measuring about 0.8 mm. to 1.1 mm. long in these forms), and the body setae are generally longer with very few or none of the conspicuously longer setae found on both surfaces of *D. littorea*.

The collections listed above, except for the Ulithi record, contain only immature females of the second or third larval instar. The absence of adult individuals in these collections probably reflects the habits of the mature mated females. In other species of the genus *Drosicha*, mated females leave the host plant and secrete themselves in ground litter prior to formation of the ovisac (Kuwana, 1922). It seems likely that *D. littorea* may have a similar habit. The fact that the single adult female specimen available is of no greater size than the larger third-instar nymphs, and that it contains no discernible embryos, suggest that this may have been an unmated individual, and that mature females distended with embryos are likely to be considerably larger than the holotype.

Takahashi (1941 : 213) reported a *Drosicha* sp., immature individuals only, from "Enderdy: Polwat," presumably Puluwat [or Enderby] Atoll in the Western Carolines, on *Scaevola frutescens*. This is probably the same as the species described above.

TRIBE ICERYINI

Genus **Crypticerya** Cockerell

Crypticerya Cockerell, 1895, Psyche **7**, Suppl. 1 : 15.—Morrison, 1928, U.S. Dept. Agric., Tech. Bull. **52** : 200.

Type of genus: *Icerya rosae* Riley and Howard.

2. Crypticerya jacobsoni (Green).
Icerya jacobsoni Green, 1912, Tijdschr. Ent. **55** : 316.
Crypticerya jacobsoni: Morrison, 1928, U.S. Dept. Agric., Tech. Bull. **52** : 203.—Rao, 1950, Indian Jour. Ent. **12** (2) : 146, pl. 18.

DISTRIBUTION: Java (type locality), China, Philippine Is., India, Burma, Micronesia (?).

HOSTS: Recorded from *Leucaena leucocephala* (*L. glauca*) and *Macaranga carolinensis* in Micronesia, and a number of other plants elsewhere.

Takahashi reports this species from Saipan (1936 : 115), Palau (1939 : 238), and Yap (1941 : 214), but no specimens were found in material available for this study.

Genus **Icerya** Signoret

Icerya Signoret, 1875, Soc. Ent. France, Ann. V, **5** : 351.—Morrison, 1928, U.S. Dept. Agric., Tech. Bull. **52** : 203.—Rao, 1950, Indian Jour. Ent. **12** (1) : 39 and **12** (2) : 127, figs.

Type of genus: *Coccus sacchari* Guerin (= *Dorthesia seychellarum* Westwood ?).

For redescriptions and figure of the species discussed below see treatment of Oriental Iceryini by V. P. Rao (1950).

KEY TO SPECIES OF ICERYA REPORTED FROM MICRONESIA

1. With 2 pairs of abdominal spiracles; body thickly clothed with long black setae, forming large conspicuous tufts on lateral margins of abdominal segments; ovisac elongate, normally longer than body of female when fully developed, with a series of well-defined longitudinal flutes..... **purchasi**
With 3 pairs of abdominal spiracles; body less densely clothed with setae, marginal setae present but relatively sparse and not forming conspicuous tufts; ovisac less strongly developed, usually shorter than body of female, longitudinal fluting less well defined..... 2
2. Dorsum with large disc-shaped open center pores, around 16–20 μ diameter, in addition to usual multilocular pores (10–12 μ diameter); with 3 round or oval ventral cicatrices; wax covering of female partly yellowish in life..... **seychellarum**
Dorsum without such large open center disc pores in addition to usual multiloculars; with a single, roughly circular, ventral cicatrix; wax covering of females entirely white..... **aegyptiaca**

3. Icerya aegyptiaca (Douglas).

Crossotosoma aegyptiaca Douglas, 1890, Ent. Mo. Mag. **27**: 79.
Icerya aegyptiacum: Riley and Howard, 1890, Ins. Life **2**: 256.
Icerya aegyptiaca: Newstead, 1893, Ent. Mo. Mag. **29**: 167.—Rao, 1950, Indian Jour. Ent. **12**(1): 51, pl. iv.
Icerya tangalla Green, 1897, Indian Mus. Notes **4**: 7.

DISTRIBUTION: Widespread in Old World tropics, including oceanic islands (type locality: Egypt).

N. MARIANA IS. PAGAN: Feb. 1959, Cantelo, on coconut. ANATAHAN: July 1951, R. Bohart, on banana; Feb. 1959, Cantelo, on breadfruit.

S. MARIANA IS. TINIAN: Camp Chuco, June 1946, Oakley, on *Ficus*. AGIGUAN: south side, June 1952, Kondo, on native plant. ROTA: near Sabana, June 1946, Townes, on *Laportea*. GUAM: Jan.–Apr. 1945, R. H. Baker; Pilgo River, May 1945, Bohart and Gressitt; Ritidian Point, June 1945, Bohart and Gressitt; Mt. Alifan, Apr. 1946, Krauss; Mt. Alutom, June 1946, Townes, on *Blechnum pyramidalum* and *Flagellaria indica*; Talofofo, Dec. 1947, Maehler, on croton; Com. Mar. Hill (near Agana), Jan.–Feb. 1949, Maehler, on croton; Aug. 1953, Liming, on croton; Jan. 1954, Liming, on *Artocarpus incisus* (= *A. altilis*); Cocos I., Feb. 1954, Beardsley, on *Scaevola*.

PALAU. KOROR: Mar. 1948, Maehler, on unidentified plant, July 1953, Beardsley, on breadfruit, and *Casuarina*. NGERKABESANG (Arakabesan): July 1956, McDaniel. PELELIU: Sept. 1945, Baker; Jan. 1948, Dybas, sweeping. ANGAUR: May 1954, Beardsley.

YAP. YAP: July 1946, Oakley, on *Macaranga*; Guror, Mar. 1949, Maehler, on unidentified plant; Dugor, Mar. 1949, Maehler, on *Artocarpus altilis*; S. Keng, Aug. 1950, Goss, on *Artocarpus*; hill behind Kolonia, Nov. 1952, Gressitt; Dugor to Rumung, Nov. 1952, Gressitt; near Keng, Apr. 1954, Beardsley, on *Macaranga*. MAP: Oct. 1952, Krauss, on *Ficus*.

CAROLINE ATOLLS. ULITHI: Fassarai I., July 1946, Oakley, on *Artocarpus altilis* and *Ficus*; Fassarai I., July 1946, Townes, on *Artocarpus altilis*; Mogmog I., July 1946, on *Artocarpus altilis* and taro; Pontangeras I., Nov. 1947, Dybas; Asor I., Oct. 1952, Krauss, on *Scaevola*; Falalop I., Apr. 1954, Beardsley, on breadfruit. FAIS: Oct. 1952, Krauss, on banana; Apr. 1954, Beardsley, on breadfruit, banana, citrus, and *Calophyllum inophyllum*. NOMWIN: May 1946, Oakley, on *Euphorbia*; Nomwin I., Feb. 1954, Beardsley, on breadfruit, citrus, and papaya; Fananu I., Feb. 1954, Beardsley, on breadfruit and *Scaevola*. E. FAYU: Oct. 1952, Beardsley, on *Scaevola*.

TRUK. WENA (Moen): Feb. 1948, Maehler, on breadfruit; Mar. 1949, Potts; Oct. 1952, Beardsley, on *Vigna marina*. TONOAS (Dublon): Oct. 1952, Beardsley on croton. TON (Tol): Mt. Unibot, Jan. 1953, Gressitt. PIS:

June 1946, Townes on various hosts; Feb. 1954, Beardsley, on breadfruit.

PONAPE. Colonia, Mar. 1948, Dybas, on inflorescence of *Hyophorbe verschaffeltii*; Nanipil, Net District, 300 m., Mar. 1948, Dybas; Colonia, Nov. 1953, Beardsley, on *Glochidion* sp.; Colonia, Feb. 1962, Gordon.

WAKE. Nov. 1959, Ford, on *Scaevola frutescens*.

MARSHALL IS. KWAJALEIN: Apr. 1948, Maehler, on *Scaevola*; Eru I., Apr. 1948, Maehler, on *Wedelia biflora*; Nov. 1952, G. Howe, on breadfruit; Oct. 1953, Beardsley, on breadfruit; Ebeye I., Oct. 1953, Beardsley, on young coconut; Kwajalein I., Oct. 1953, Beardsley, on *Ochrosia*; Apr. 1960, Clagg, on croton; Ebeye I. Apr. 1958, on Euphorbiaceae, Gressitt, Dec. 1958, Krauss. LAE: Lae I., Oct. 1953, Beardsley, on breadfruit. AILINGLAPALAP: Bikajela I. Aug. 1946, Oakley, on breadfruit and banana; June 1949, d'Laubenfels, on breadfruit. JALUIT: Jabor I., Aug. 1946, Oakley, on *Artocarpus altilis* and "cucurbita"; Pinlep I., Oct. 1953, Beardsley, on breadfruit. LIKIEP: Likiep I., Aug. 1946, Oakley, on breadfruit; Mar. 1950, Langford; June 1958, Umhoefer, on breadfruit and *Casuarina* leaves. MAJURO: Uliga I., June 1958, Owen, on *Codiaeum* leaves.

GILBERT IS. BUTARITARI: Butaritari I., Dec. 1957, Krauss, on leaves of *Pluchea odorata*, and *Scaevola*. TARAWA: Betio I., Nov. 1957, Krauss, on breadfruit leaves. Hall (1954) reported outbreaks of this species on breadfruit on Butaritari (Makin) Atoll during August, 1953.

HOSTS: Bananas, breadfruit, citrus, coconut, taro, and a number of ornamental and uncultivated plants. Takahashi (1936–1942) reports this species from Saipan, Palau, Truk, and Jaluit on avocado, breadfruit, *Casuarina*, cotton, croton, and *Euphorbia*.

This species has been a serious economic pest in several parts of Micronesia, particularly on breadfruit. A coccinellid beetle, *Rodolia pumila* Weise, has been introduced and spread in Micronesia to combat this margarodid, and has given satisfactory control in most areas where it is known to be established (Beardsley, 1955). Hall (1954) states that *R. cardinalis* (Mulsant) was introduced into Butaritari to combat this pest.

4. Icerya purchasi Maskell.

Icerya purchasi Maskell, 1878, New Zealand Inst. Trans. **11** : 221.—Rao 1950, Indian Jour. Ent. **12**(2) : 132, pl. 12.

DISTRIBUTION: Widespread (type locality: New Zealand).

S. MARIANA IS. GUAM: June 1937, Oakley, on lime; Marine Barracks, Nov. 1938, Oakley, on orange; Mt. Lamlam, Dec. 1958, Krauss, on *Casuarina* twig.

WAKE. Nov. 1957, Krauss, on *Casuarina*; Nov. 1959, Ford, on *Scaevola frutescens*.

MARSHALL IS. ENIWETOK: "Nan" I., July 1957, Tuthill, on *Casuarina*.

KWAJALEIN: Kwajalein I., May 1958, Owen, on *Casuarina*; May 1960, Clagg, on *Casuarina*. MAJURO: Uliga I., May 1958, Owen, on *Casuarina*.

GILBERT IS. TARAWA: Bairiki I., Dec. 1957, Krauss, on branches of *Casuarina*.

HOSTS: Reported from *Casuarina*, citrus, and *Scaevola* in Micronesia; recorded from numerous other hosts elsewhere.

The history of the economic importance and biological control of this species is well known. Of the several infestations discovered in the Marshall Islands within the past few years, attempts at eradication have been made at Eniwetok and Majuro, and these may have been successful. On Guam the species is controlled by *Rodolia cardinalis* (Mulsant). This coccinellid has been introduced also to Kwajalein and Eniwetok, but has not been found established.

5. Icerya seychellarum (Westwood).

Dorthesia seychellarum Westwood, 1855, Gardener's Chronicle, 830 (not seen).

Coccus sacchari Guerin, 1867, Rev. Mag. Zool. II, **9**: 451 (not seen).

Icerya seychellarum: Maskell, 1897, New Zealand Inst., Trans. **29**: 329.—Morrison, 1928, U.S. Dept. Agric., Tech. Bull. **52**: 203, figs. 109–111. —Rao, 1950, Indian Jour. Ent. **12** (2): 135, pl. 13.

DISTRIBUTION: Widespread in Old World tropics and subtropics (type locality: Seychelles Islands).

PALAU. Takahashi (1936: 116) records this species from Angaur, Palau Is. I have not seen specimens of this species from Palau.

YAP. YAP: July 1946, Oakley, on citrus; near Kolonia, Mar. 1954, Beardsley, on citrus leaves.

CAROLINE ATOLLS. ULITHI: Dec. 1944, Hensell, on breadfruit; Mogmog I., July 1946, Oakley, on *Eugenia* and coconut; July 1946, Townes, on *Achyranthes aspera*; Fassarai I., July 1946, Oakley, on *Citrus*; Falalop I., Dec. 1952, Krauss, on coconut; Apr. 1954, Beardsley, on breadfruit and *Eugenia* sp.

OCEAN I. (Banaba): Dec. 1957, Krauss, on unidentified plant.

HOSTS: Recorded hosts in Micronesia include breadfruit, coconut, citrus, and several other plants of less economic importance. *I. seychellarum* has been reported elsewhere as a pest of sugar cane, but most if not all of these records may apply actually to *I. pilosa* Green. The latter species was usually considered to be a synonym of *I. seychellarum* until recently, but Rao (1950: 127) considers *I. pilosa* a valid species. The latter is apparently restricted principally to graminaceous hosts, whereas *I. seychellarum* seems to occur only on non-graminaceous plants. These facts raise a question as to the designation of the proper type species of *Icerya*. It seems possible that *Coccus sacchari* Guerin, published as a *nomen nudum*, may have been

the same as *I. pilosa*, rather than *I. seychellarum*. The solution of this problem is beyond the scope of this paper.

Icerya seychellarum has been a serious pest of breadfruit in Samoa. At Ulithi in 1954, apparently in the absence of any effective predators, *I. seychellarum* and *I. aegyptiaca* were found in heavy, often mixed infestations on breadfruit.

Genus **Steatococcus** Ferris

Steatococcus Ferris, 1921, Stanford Univ. Ser. Biol. Sci. **1** (2) : 69.—Morrison, 1928, U.S. Dept. Agric., Tech. Bull. **52** : 214.

Type of genus: *Palaeococcus morrilli* Cockerell.

6. Steatococcus samaraius Morrison.

Steatococcus samaraius Morrison, 1927, Biol. Soc. Washington, Proc. **40** : 109.

DISTRIBUTION: New Guinea (type locality), Solomon Islands, Caroline Islands.

PALAU. BABELTHUAP: Ngerehelong, Dec. 1947, Dybas; Ulimang, Dec. 1947, Dybas. KOROR: July 1946, Oakley, on *Acacia*; Nov. 1947, on large leaf taro; Mar. 1948, Maehler, on citrus, *Hibiscus tiliaceus*, malvaceous plant, *Psidium guajava*, and unidentified plant; Apr. 1949, Langford; Feb.–July 1953, Beardsley, on *Acalypha* spp., banana, *Casuarina*, coconut, *Erythrina* sp., and rose; July 1958, Owen, on *Casuarina*.

YAP. YAP: Balabat, Dec. 1963, Owen, on banana.

HOSTS: Found in Palau on a variety of hosts including banana, coconut, giant taro, guava, and various ornamental and wild plants.

In Palau, *S. samaraius* is preyed upon by a coccinellid beetle, *Rodolia pumila*, and apparently has not become a pest of major importance.

Specimens of *S. samaraius* are also at hand from the following localities in the Solomon Islands: Guadalcanal, Nov. 1954, Brown; and Malaita, June 1954, Brown. This species has not been reported previously from the Solomons.

FAMILY ORTHEZIIDAE

A single species belonging to this relatively small and well-defined group of coccids has been identified from Micronesia. The entire family has been admirably treated in monographs by Morrison (1925; 1952).

Genus **Nipponorthezia** Kuwana

Nipponorthezia Kuwana, 1916, Annot. Zool. Japon. **9** : 150 (not seen).—Morrison, 1925, Jour. Agric. Res. **30** (2) : 153.

Ortheziella Silvestri, 1924, Roy. Soc. Espan. Hist. Nat., Bol. **24** : 170.

Type of genus: *Nipponorthezia ardisiae* Kuwana.

7. Nipponorthezia guadalcanalia Morrison.

Nipponorthezia guadalcanalia Morrison, 1952, U.S. Dept. Agric., Tech. Bull. **1052**: 73.

DISTRIBUTION: Solomon Is. (type locality: Guadalcanal I.), Micronesia, Hawaii.

PALAU. BABELTHUAP: Ngatpang, 65 m., Dec. 1952, Gressitt.

YAP. YAP: North Yap, July–Aug. 1950, Goss, ex Berlese funnel; Mt. Tabiwol (Mt. Gillifitz), 150 m., Nov. 1952, Gressitt, ex Berlese funnel; hill behind Kolonia (Yaptown), Dec. 1952, Gressitt, ex Berlese funnel.

TRUK. TON (Tol): Mt. Unibot, Jan. 1953, Gressitt, ex rotting banana stalk and ex Berlese funnel.

KUSAIE. "Hill 1575," 230 m., Feb. 1953, Clarke; "Hill 1515," Feb. 1953, Clarke, ex trash from forest floor; "Hill 1010," Feb. 1953, Clarke, ex tree below epiphyte; Mt. Matante, Mar. 1953, Clarke.

HOSTS: Unknown. The available specimens are all from Berlese funnel collections from ground litter, or otherwise indicated as probably from decaying vegetable matter. It is likely that this is a root-feeding form. The Micronesian specimens were compared with the holotype in Washington, D.C.

FAMILY PSEUDOCOCCIDAE

The mealybugs comprise one of the largest families of the Coccoidea. The group is of nearly worldwide distribution, and includes many important pests of plant crops. The Micronesian pseudococcid fauna contains a number of the common pest species which have been widely disseminated by man, as well as several presumably endemic elements. Some of the species as yet known only from Micronesia may be expected to turn up in other areas of the southwestern Pacific when the mealybug fauna of this vast region has been more thoroughly studied. Among the possibly endemic forms, the mealybug species associated with Pandanaceae (*Pandanus* and *Freycinetia*) are of particular interest. The relative wealth of species attached to these plants in Micronesia suggests that *Pandanus* and its relatives should prove a fertile source of pseudococcid species in other areas of the Pacific as well. The Micronesian material available from grasses, and from plant roots generally, although very limited in number of specimens, has yielded several new forms, suggesting that further collecting from such host sources will likely prove rewarding.

At present, the generic classification of the Pseudococcidae seems somewhat unsettled. Many new genera have been proposed in recent years as authors have attempted to devise workable classificatory arrangements (see Ferris, 1950, 1953; Borchsenius, 1949, McKenzie, 1960; Williams, 1960, 1962). Most of these new genera are described in faunistic studies which

treat limited geographical areas, and frequently those proposed for the fauna of a given region cannot be applied to other faunae without serious modification of generic definitions or the erection of still more new genera to accomodate intermediate forms. What is needed is a revisionary study of the Pseudococcidae of worldwide scope, and one which treats the male sex as well as the neotenic females. That the males can be useful in mealybug taxonomy has been shown elsewhere (Beardsley, 1960, 1962). As males appear to be relatively conservative structurally, they may eventually prove of value in delimiting supraspecific categories within the Pseudococcidae. For the great majority of mealybug species, however, the males remain unknown or undescribed.

Although I have accepted several recently proposed mealybug genera which are based upon species which occur in Micronesia, for example, *Laminicoccus* Williams, I have proposed new genera only for those species which obviously cannot be accommodated within current concepts of existing genera. In two genera, *Pseudococcus* Westwood and *Dysmicoccus* Ferris, species have been assigned which do not seem closely allied to the respective type species of these genera. As presently constituted, these two groups appear to be polyphyletic. However, in view of the present state of pseudococcid taxonomy, it seems unwise to propose additional new genera at this time.

For a general consideration of mealybug morphology and explanation of the terms employed here, the reader is referred to Ferris (1950) and McKenzie (1960). Recent workers have begun to utilize certain morphological characters in mealybug taxonomy which were largely ignored by Ferris in his monumental "Atlas." Among these are the number and distribution of micropores (tiny translucent spots or pores) which are often found on the legs, particularly those of the metathorax, and sometimes in the derm surrounding the bases of the hind legs; and the presence or absence and distribution of small discoidal pores (sieve pores of some authors) which differ distinctly from the usual multilocular disc pores. These discoidal pores are fairly numerously scattered over the body, particularly the dorsum, on some species assigned to *Dysmicoccus*, for example, *D. brevipes* (Cockerell) and *D. neobrevipes* Beardsley, and are present in some species of *Pseudococcus*, such as *P. obscurus* Essig, where they are reduced to a very few on the hind margins of the eyes and sometimes on the venter of the anal lobes. Proper study of these microscopic structures requires carefully prepared and well-stained specimens.

The size and shape of appendages have also been utilized to a limited extent in recent works dealing with mealybugs, as by McKenzie, 1960. The legs and antennae often vary considerably in length even among specimens from a single collection, and these measurements have been used only sparingly in the descriptions and keys which follow. The length of the

rostrum or "beak" appears to be subject to less intraspecific variation than are the lengths of other appendages, and this character has been used fairly frequently in the treatment of the Micronesian mealybugs which follows. Satisfactory measurement of the length of the rostrum requires specimens in which this structure lies parallel to the cover glass, which is not always the case. The length of this structure, as indicated in the accompanying figures, is measured from the anterior margin of the small baso-lateral sclerite (this generally bears three setae, but is not always distinctly separated from the next segment) to the apex of the distal segment. For a diagram which illustrates the morphological terms employed here see McKenzie (1960, fig. 1).[4]

Key to Micronesian Genera of Pseudococcidae

ADULT FEMALES

1. Legs absent; antennae reduced to 1- or 2-segmented stubs; body in fully mature individuals relatively heavily sclerotized 2
   Legs present; antennae with 5 or more segments; body not heavily sclerotized at maturity 3
2. With a roughly circular depressed area containing numerous very small tubular ducts situated on venter behind each posterior spiracle; posterior abdominal segments differentiated, their lateral margins steplike in appearance... **Chaetococcus**
   Without such an area of very small tubular ducts behind posterior spiracle; posterior segments of abdomen less strongly differentiated; their lateral margins not steplike ..... **Antonina**
3. Anal lobes strongly protuberant and sclerotized, each bearing at apex a single large spinelike process nearly as long as the lobe; living on roots of various plants ..... **Geococcus**
   Anal lobes less protuberant, partly to completely unsclerotized, without such a large spinelike process 4
4. Body bearing conspicuous bi- or tritubular pores (fig. 22) in addition to other types; antennae 5- or 6-segmented, set close together on head; small root-inhabiting species ..... **Rhizoecus**
   Without such bi- or tritubular pores; antennae 6- to 9-segmented, set farther apart on head 5
5. Cerarii limited to not more than 3 pairs, 1 each on last, penultimate, and sometimes antipenultimate abdominal segments, and without a continuous lateral fringe of long conical setae; cerarii sometimes wanting 6
   With 4 or more pairs of marginal cerarii, or with a more or less continuous lateral fringe of long conical setae 11
6. Dorsum bearing large tubular ducts with orifices each surrounded by a conspicuous sclerotized area from which 1 or more setae arise ..... **Ferrisia**
   Dorsum without such tubular ducts 7

[4] At the time this paper was written, I followed Ferris' interpretation of abdominal segmentation in the Pseudococcidae (Ferris 1950 : 5). Based on the position of the female vulvar opening, Ferris postulated that the anal lobes belong morphologically to abdominal segment 9, the dorsal ostioles to segment 7, and that the true first abdominal segment is not clearly discernible. The numbering of abdominal segments used in the present paper is based on this system. Since preparing this manuscript I have concluded, from evidence furnished by the adult males and from the opinions of other authors, that Ferris' interpretation of segmentation may not have been correct. In a paper written more recently, I have numbered the segments differently, referring to the first discernible segment as segment 1, etc. (Beardsley 1965 : 56, footnote.)

7. Circulus large, hourglass-shaped; last three abdominal segments each with a conspicuous long seta on each lateral margin ..... **Saccharicoccus**
   Circulus relatively small or absent; long setae present on anal lobes only 8
8. Venter of anal lobes each with a narrow elongate sclerotized area; typical cerarii bearing conical setae wanting; with a few oral-rim tubular ducts present on lateral margins of dorsum ..... **Palaucoccus**
   Venter of anal lobes without such an elongate sclerotized area; with 1 to 3 pairs of cerarii bearing conical setae on posterior abdominal segments; oral-rim tubular ducts absent 9
9. Trilocular pores very few or wanting, if present then limited to a few associated with cerarii ..... **Neoripersia**
   Trilocular pores moderately plentiful, scattered over both dorsum and venter 10
10. Body of mature female decidedly turbinate in form; anal ring setae elongate, about three times as long as anal ring ..... **Turbinococcus**
    Body elongate or elongate-oval; anal ring setae shorter, less than twice as long as anal ring ..... **Trionymus**
11. Micronesian species with a conspicuous unbroken fringe of elongate conical setae completely around lateral margin of body ..... **Neosimmondsia**
    Conical setae arranged in definite cerarii, without such an unbroken marginal fringe ... 12
12. Ventral derm surrounding attachment of hind coxae with a patch of minute tubular ducts ..... **Palmicultor**
    Ventral derm without such a patch of minute ducts near bases of hind coxae 13
13. Anal lobe cerarii each with more than 2 conical setae 14
    Anal lobe cerarii each normally with but 2 conical setae 16
14. Body form at maturity rotund; anal ring located on dorsum, one-half its length or more from posterior margin of body; with 18 pairs of fairly distinct marginal cerarii ..... **Paraputo**
    Body form oval to elongate; anal ring with its hind margin at posterior apex of dorsum; with 17 or fewer pairs of distinct marginal cerarii 15
15. With 17 pairs of cerarii, each borne on a definite sclerotized plate ..... **Laminicoccus**
    With 17 or fewer pairs of cerarii, not borne on definite sclerotized plates, derm surrounding anal cerarii sometimes slightly sclerotized ..... **Dysmicoccus** (in part)
16. Tarsal claws each with a minute tooth on inner face ..... **Phenacoccus**
    Tarsal claws without such a tooth on inner face 17
17. With 18 pairs of marginal cerarii; venter of anal lobes with a narrow, elongate, barlike sclerotized area extending anteriorly from anal lobe seta ..... **Planococcus**
    With 17 or fewer pairs of cerarii; venter of anal lobes without such a narrow barlike sclerotized area 18
18. Multilocular disc pores numerous, scattered on both dorsal and ventral surfaces; tubular ducts of an extremely shallow type, their depth no greater than diameter of orifice ..... **Pandanicola**
    Multilocular disc pores less numerous, largely restricted to venter of abdomen, occasionally with a few on venter of head and thorax, absent on dorsum; tubular ducts conspicuously deeper than diameter of orifice 19
19. One or more oral-rim tubular ducts usually present on dorsum; if wanting, then with multilocular disc pores confined to margin of vulva ..... **Pseudococcus**
    Without oral-rim tubular ducts; multilocular disc pores present on several abdominal segments anterior to vulva ..... **Dysmicoccus** (in part)

Genus **Antonina** Signoret

Antonina Signoret, 1875, Soc. Ent. France, Ann. V, **5**: 24.—Ferris, 1953, Atlas Scale Ins. North America **6**: 269.

Type of genus: *Antonina purpurea* Signoret.

8. Antonina graminis (Maskell).

Sphaerococcus graminis Maskell, 1897, Ent. Mo. Mag. **11** (8) : 244.

Antonina graminis: Fernald, 1903, Cat. Coccidae of World, 121.—Zimmerman, 1948, Insects of Hawaii **5** : 156, fig. 91.

Antonina indica Green, 1908, Dept. Agric. India (Ent. Ser.) Mem. **2** : 27, pl. 3, fig. 11.—Takahashi, 1941, Tenthredo **3** (3) : 217.

Antonina boutelouae: Fullaway, 1946, B. P. Bishop Mus., Bull. **189** : 158 (not *A. boutelouae* Parrott, 1900).

DISTRIBUTION: Africa, China (type locality), Southwestern North America, Hawaii, Johnston Island, Micronesia.

S. MARIANA IS. GUAM: Piti, June 1911, Fullaway, on *Cynodon*; in quarantine at San Pedro, Oct. 1947, J. H. Michel, on Graminae. SAIPAN: Kalabera, no date, Esaki (?), on *Digitaria* grass. Takahashi (1941 : 217) records this species as *A. indica* from Saipan on grass.

PALAU. KOROR: June 1953, Beardsley, on large variegated grass.

TRUK. TONOAS (Dublon): Oct. 1952, Beardsley, on *Cynodon dactylon.*

WAKE. Nov. 1959, Ford, on lower stems of grass.

MARSHALL IS. KWAJALEIN: In quarantine at Hawaii, Nov. 1946, Jones, on *Cynodon dactylon.*

JOHNSTON I. May, 1946, Krauss.

HOSTS: Various grasses including *Cynodon dactylon* and *Digitaria* sp.

Adults of an encyrtid parasite, *Dusmetia sangwani* Rao, emerged from specimens collected on Wake Island by Ford.

This species has been adequately redescribed and figured by Ferris (1948). As Williams (1958 : 206) has previously pointed out, Ferris' later redescription and figure (1953 : 294, fig. 112) are misleading in that the presence of dorsal trilocular pores is not indicated. Furthermore, Ferris uses the supposed absence of these pores to separate the species from *A. crawii* Cockerell in his key to North American species. However, Dr. Harold Morrison informed me (personal communication) that dorsal trilocular pores are present in the *A. graminis* specimens studied by Ferris. Such pores are present in all Micronesian and Hawaiian specimens which I have examined.

The slides upon which Fullaway based his 1946 record of *A. boutelouae* Parrott from Guam were examined during this study and found to be *A. graminis.*

Genus **Chaetococcus** Maskell

Chaetococcus Maskell, 1898, New Zealand Inst., Trans. **30** : 249.—Morrison and Morrison 1922, U.S. Nat. Mus., Proc. **60** (12) : 55.

Type of genus: *Sphaerococcus bambusae* Maskell.

This genus is closely allied to the preceding, and was considered ques-

tionably distinct by Morrison (1922) and others. However, several recent workers apparently have accepted *Chaetococcus* as distinct from *Antonina* (Borchsenius, 1949; Williams, 1958).

9. Chaetococcus bambusae (Maskell).

Sphaerococcus bambusae Maskell, 1892, New Zealand Inst., Trans. **25**: 237.

Chaetococcus bambusae (Maskell), 1898, New Zealand Inst., Trans. **30**: 249.—Morrison and Morrison, 1922, U.S. Nat. Mus., Proc. **60** (12): 56, fig. 18.—Williams, 1958, Brit. Mus. (Nat. Hist.) Ent. Bull. **6** (8): 206, fig. 1.

Kermicus bambusae: Kirkaldy, 1902, Fauna Hawaiiensis **3** (2): 104.

Antonina bambusae: Fullaway, 1923, Hawaiian Ent. Soc., Proc. **5**:310.—Zimmerman, 1948, Insects of Hawaii **5**: 150.

DISTRIBUTION: Widespread in Oriental and Ethiopian regions, Hawaii (type locality), S. Mariana Is., Western Caroline Is.

S. MARIANA IS. SAIPAN: Civ. Ad. Center, Feb. 1946, Maehler, on bamboo; Japanese Expt. Sta. site, June 1946, Oakley, on bamboo. Takahashi (1939: 261 and 1941: 217) recorded this species from Saipan, on bamboo.

PALAU. KOROR: July 1946, Oakley, on bamboo.

YAP. YAP: Sept. 1956, McDaniel, on bamboo.

HOSTS: Bamboos.

Genus **Dysmicoccus** Ferris

Dysmicoccus Ferris, 1950, Atlas Scale Ins. North America **5**: 53.

Type of genus: *Dactylopius brevipes* Cockerell.

The species presently assigned to this genus do not appear to constitute a monophyletic group, and *Dysmicoccus* seems to have become a convenient receptacle for *Pseudococcus*-like species lacking dorsal oral-rim tubular ducts or other particularly distinguishing features. McKenzie (1960) has assigned to this genus such species having six or more pairs of marginal cerarii, while those with five or fewer pairs of cerarii are placed by him in *Trionymus*. When the world pseudococcid fauna becomes more adequately known it will almost certainly become necessary to define *Dysmicoccus* more strictly. The type species and certain others which are probably of Neotropical origin, for example *D. neobrevipes* Beardsley and *D. probrevipes* Morrison, possess certain features in common, such as the presence of small dorsal discoidal pores and multiple conical setae in all abdominal cerarii except those of the anal lobes, and the genus should perhaps be restricted to such forms. However, for the purposes of this paper I have accepted McKenzie's concept of the genus.

KEY TO MICRONESIAN SPECIES ASSIGNED TO DYSMICOCCUS

1. With 17 pairs of marginal cerarii 2
   Normally with but 4 to 6 pairs of marginal abdominal cerarii, plus an interantennal pair ..... **boninsis**
2. Body with scattered small disclike pores (discoidal pores), in addition to the usual larger multilocular disc pores, always evident on dorsum of posterior abdominal segments and frequently scattered elsewhere on body 3
   Body without such small disclike pores 4
3. Sclerotized area on venter of anal lobes relatively elongate, at least twice as long as wide; dorsum of abdominal segment 9 without a median patch of conspicuous long setae ..... **neobrevipes**
   Sclerotized area on venter of anal lobe about as wide as long; dorsum of abdominal segment 9 with a median patch of conspicuously elongate setae, 45–80 μ long ..... **brevipes**
4. Anal lobe cerarii normally with but 2 large conical setae borne on a distinctly sclerotized area; tubular ducts absent on dorsum ..... **wistariae**
   Anal lobe cerarii normally with more than 2 conical setae, the surrounding derm unsclerotized; tubular ducts present dorsally near almost every cerarius. **saipanensis**

10. Dysmicoccus boninsis (Kuwana).

Pseudococcus calceolariae Kirkaldy, 1902, Fauna Hawaiiensis **3** (2) : 103 (not *Dactylopius calceolariae* Maskell, 1879).

Dactylopius (*Pseudococcus*) *boninsis* Kuwana, 1909, New York Ent. Soc., Jour. **17** (4) : 161.

Trionymus calceolariae Fullaway, 1923, Hawaiian Ent. Soc., Proc. **5** (2) : 312 (not *Dactylopius calceolariae* Maskell, 1879).

Pseudococcus boninsis: Morrison, 1925, Jour. Agric. Res. **31** (5) : 489.—Zimmerman, 1948, Insects of Hawaii **5** : 185, fig. 104.

Dysmicoccus boninsis: Ferris, 1950, Atlas Scale Ins. North America **5** : 57, fig. 18.—Beardsley, 1960, Hawaiian Ent. Soc., Proc. **17** (2) : 216, fig. 2, E (male).

DISTRIBUTION: Nearly pantropical, including Hawaii and Micronesia (type locality: Bonin Is.).

S. MARIANA IS. GUAM: Sept. 1911, Fullaway, on sugar cane; Com. Mar. Hill, Dec. 1948, Maehler, on sugar cane.

PALAU. BABELTHUAP: July 1946, Townes, on Jobs tears (*Coix lacryma-jobi*). KOROR: March 1948, Maehler, on *Coix lacryma-jobi.*

CAROLINE ATOLLS. FAIS: Jan. 1964, Bianchi, on sugar cane. WOLEAI: Utegal I., July 1946, Oakley, on sugar cane; Falalis I., Feb. 1953, Beardsley, on sugar cane. FARAULEP: Faraulep I., Jan. 1964, Owen, on sugar cane nodes.

TRUK. TON (Tol): May, 1946, Oakley, on sorghum.

PONAPE. Colonia, Feb. 1948, Dybas, on sugar cane.

HOSTS: Sugar cane, sorghum, Jobs tears. It probably occurs also on other large grasses.

Although the type locality of this species is the Bonin Islands, no specimens from these islands were present in the survey material studied. The whereabouts of Kuwana's type material is unknown.

Takahashi (1941 : 215) records *Trionymus taiwanus* Takahashi from Saipan. In 1955, Dr. Morrison examined a slide, now in the Formosa Experiment Station, labeled "Mariana Isls/Saipan:/Tsukimijima/2. vii. 1939, T. Esaki, *Trionymus taiwanus* Takah., host: grass roots (Det. R. Takahashi)." The slide bore a single specimen which apparently was part of the material upon which Takahashi's record was based. Dr. Morrison concluded that the specimen was identical with *Dysmicoccus boninsis* (Kuwana). He also examined specimens of *T. taiwanus* from Formosa received from Takahashi, and noted that this material also appeared to be the same as *D. boninsis*. Therefore, it is probable that *T. taiwanus* is a synonym of *D. boninsis*, although, for confirmation, an examination of the type of the former should be made.

11. Dysmicoccus brevipes (Cockerell).

Coccus bromeliae Bouché, 1834, Naturgesch. Ins. 20 (not seen), preoccupied by *Coccus bromeliae* Kerner, 1778 (see Morrison, 1929 : 34).

Pseudococcus bromeliae (Bouché), of authors.

Dactylopius brevipes Cockerell, 1893, Entomologist **26** : 267.

Pseudococcus brevipes: Fernald, 1903, Cat. Coccidae of World, 98.—Zimmerman, 1948, Insects of Hawaii **5** : 189, fig. 105.—Balachowsky, 1957, Rev. Path. Veg. Ent. Agric. France **36** (4) : 189, fig.

Pseudococcus palauensis Kanda, 1933, Annot. Zool. Japon. **14** : 135 (not seen; synonymy according to Takahashi, 1936 : 109).

Dysmicoccus brevipes: Ferris, 1950, Atlas Scale Ins. North America **5** : 59, fig. 19.

DISTRIBUTION: Most tropical and subtropical parts of the world (type locality: Jamaica) including Hawaii and Micronesia.

S. MARIANA IS. SAIPAN: June 1946, Townes, on pineapple and *Pandanus fragrans*. TINIAN: March 1945, E. Hagen; June 1946, Oakley, on pineapple. AGIGUAN: June 1952, Kondo. ROTA: Sabana, June 1946, Townes, on *Pandanus tectorius*. GUAM: Piti, June 1911, Fullaway, on pineapple and on *Annona muricata*; Dec. 1911, Fullaway, on coffee; Barrigada, April 1946, Krauss, on pineapple; Mt. Alifan, April 1946, Krauss; Yona, Oct. 1952, Krauss, on palm fruits.

PALAU. KOROR: Jan. 1938, Esaki (reported as *Formicococcus* sp. by Takahashi, 1939).

YAP. Aug. 1950, Goss, on sugar cane.

TRUK. UTOT (Udot): Jan. 1949, Langford. TON (Tol): Jan. 1949, Langford, on pineapple.

PONAPE. Colonia, Aug. 1946, Oakley, on pineapple; Mar. 1948, Dybas, ex unopened inflorescence of palm, *Hyophorbe* sp.; Agric. Expt. Station near Colonia, Jan. 1953, Gressitt, on woody composite.

MARSHALL IS. MAJURO: Uliga I., June 1950, La Rivers. JALUIT: Jabor I., Aug. 1946, Oakley, on sugar cane. EBON: Ebon I., Sept. 1953, Beardsley, on sugar cane.

GILBERT IS. TARAWA: Dr. D. J. Williams reports seeing specimens from Tarawa, on coconut (personal communication).

HOSTS: This species has been reported from a wide variety of hosts throughout its range. Among plants of agricultural importance in Micronesia, it has been found on pineapple, sugar cane, coconut, *Pandanus*, coffee, and soursop (*Annona muricata*). Takahashi (1936–1942) reported this species from Saipan, Yap, and Palau, on *Annona muricata*, betel palm, *Pandanus*, and pineapple.

Dactylopius (*Pseudococcus*) *ananassae* Kuwana (1909, New York Ent. Soc., Jour. **17** : 162) described from the Bonin Islands, is very likely a synonym of *D. brevipes*. Unfortunately, no specimens of Kuwana's species have been available for study and the whereabouts of the type specimens is unknown.

Takahashi (1939 : 254) reported on a single specimen from Koror which he assigned to *Formicococcus* Takahashi, but did not name because of its poor condition. This specimen was made available to me and has been restained and remounted to facilitate critical study. It appears to be a poor, possibly aberrant specimen of *Dysmicoccus brevipes*. The characteristic discoidal pores are readily discernible, and the ventral sclerotized areas of the anal lobes are short and broad as in *D. brevipes*; certainly not narrow and barlike as in *F. cinnamoni* Takahashi, the type of the genus *Formicococcus*. The anal ring of this specimen has been pushed forward so that the posterior part of the dorsum lies over it, and it appears that some, if not all, of the supernumerary anal ring setae seen by Takahashi, which prompted him to place the specimen in *Formicococcus*, are actually the long dorsal setae of the ninth abdominal segment which are characteristic of *D. brevipes*.

Balachowsky (1957) has satisfactorily redescribed and figured the pineapple mealybug, pointing out several morphological characters, such as the discoidal pores, which were overlooked in earlier redescriptions by Ferris (1948 and 1950).

12. Dysmicoccus neobrevipes Beardsley.

Dysmicoccus neobrevipes Beardsley, 1959, Hawaiian Ent. Soc., Proc. **17** (1) : 31, figs. 1–2; 1960, ibid. **17** (2) : 217, fig. 2, F (male).

DISTRIBUTION: Hawaii (type locality), S. Mariana Is., Gilbert Is., Jamaica.

S. MARIANA IS. ROTA: Angiano, June 1946, Oakley, on *Theobroma cacao*; June 1946, Townes, on *Agave sisalana*. GUAM: Agana Swamp, June 1936, Swezey, on *Crescentia alata* fruit; Feb. 1938, Oakley, on *Barringtonia speciosa*; Mar. 1938, Oakley, on tuberose; Dec. 1953, Liming, on *Pipturus argenteus*.

GILBERT IS. TARAWA: Aug. 1956, Brown, on banana; Bairiki I., Nov. 1957, Krauss, on *Guettarda*.

HOSTS: In Hawaii, it has been reported from a variety of plants including pineapple, but not yet on grasses (see Beardsley, 1959). Reported hosts of agricultural importance in Micronesia include banana, cacao, and agave.

This species and *D. brevipes* are closely related and both are probably of Neotropical origin. In Hawaii, *D. neobrevipes* is bisexual whereas *D. brevipes* appears to be entirely parthenogenetic.

13. Dysmicoccus saipanensis (Shiraiwa), new combination (figs. 2; 21, *a*).

Pseudococcus saipanensis Shiraiwa, 1933, Yokohamazeikwan Zigyo-Gairyo, 8–10 (in Japanese; original not seen).

Pseudococcus cocotis: Takahashi, 1939, Tenthredo **2** (3) : 239.—Fullaway 1946, B. P. Bishop Mus., Bull. **189** : 157.

DISTRIBUTION: Micronesia (type locality: Saipan).

N. MARIANA IS. PAGAN: Feb. 1959, Cantelo, on coconut. ALAMAGAN: Aug. 1948, Doutt, on coconut.

S. MARIANA IS. SAIPAN: Ants Valley, June 1946, Oakley, on coconut. GUAM: Oct. 1908, Evans, on coconut; Dec. 1908, Castenoble, on coconut; Piti, June 1911, Fullaway, on coconut; Inarajan, May 1936, Usinger, on coconut; Sinajana, Sept. 1938, Oakley, coconut trunks; Oca Pt., May 1945, Dybas, on dead coconut frond; Tumon Bay, April 1946, Krauss; 1.6 km. S. E. Asan, Nov. 1947, Dybas, on coconut; Com. Mar. Hill, April 1948, Maehler, on coconut; in quarantine at Honolulu, Mar. 1953, H. Makino, on coconut.

YAP. MAP: July–Aug. 1950, Goss, on coconut palm. YAP: Guror (Goror), March 1949, Maehler, on coconut; June 1956, McDaniel, on coconut.

CAROLINE ATOLLS. LAMOTREK: Feb. 1950, Langford, on coconut. FARAULEP: Faraulep I., Jan. 1964, Owen, on coconut spike. WOLEAI: Utegal I., July 1946, Oakley, on coconut; Utegal I., Feb. 1953, Beardsley, on coconut. IFALUK: Ifaluk I., Feb. 1953, Beardsley, and Aug. 1953, Bates, on coconut. NUKUORU: Nukuoru I., Aug. 1946, Oakley, *Cocos nucifera*; Shenukdei I., Aug. 1946, Oakley, on coconut. NOMWIN: Nomwin I., Feb. 1954, Beardsley, on coconut. NAMA: Oct. 1952, Beardsley, on coconut.

TRUK. FEFAN: May 1946, Oakley, coconut. PIS: June 1946, Oakley, coconut; Feb. 1954, Beardsley, coconut foliage.

PONAPE. Colonia, Aug. 1946, Oakley, on *Cocos nucifera*.

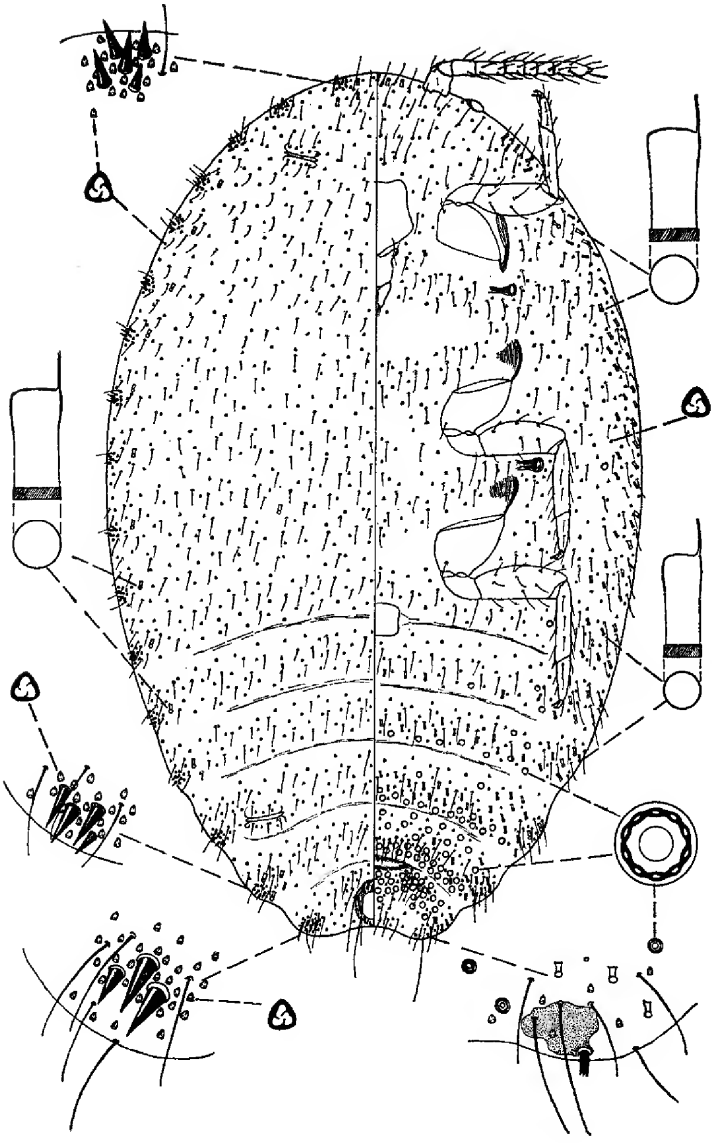

FIGURE 2.—*Dysmicoccus saipanensis*, adult female, dorsal and ventral aspects and details.

KUSAIE. Malem, Feb. 1953, Clarke, on *Cocos nucifera.*

MARSHALL IS. LAE: Lae I., Oct. 1953, Beardsley, on coconut foliage. AILINGLAPALAP: Ailinglapalap I., Aug. 1946, Oakley, on *Cocos nucifera*; Bikajela (Bigatyelang) I., Aug. 1946, on *Cocos nucifera.* MAJURO: Majuro I., Aug. 1946, Oakley, on coconut; and Sept. 1953, Beardsley, on coconut; Uliga I., June 1950, La Rivers; Jaroj (Darrit) I., June 1958, Owen, on unopened coconut spike. JALUIT: Jabwar I., Aug. 1946, Oakley, on coconut; Mejetto (Medyado) I., Aug. 1946, Oakley, on *Cocos nucifera*; Majurirok I., May 1958, Gressitt.

HOST: Coconut (*Cocos nucifera*). Takahashi (1936–1942) lists this species from coconut on Saipan, Rota, Yap, Woleai, Truk, and Jaluit.

Eventually, this may prove to be identical with *Dactylopius cocotis* Maskell. The specimens at hand from Micronesia agree fairly well with Cottier's description (1936) of what he considered to represent *D. cocotis.* However, Maskell's type specimens remain unlocated. Furthermore, specimens from the Maskell collection now in Washington, D.C. and presumably from Fiji, the type locality of *cocotis*, differ in minor respects from Micronesian *D. saipanensis*; for example, most possess several small conical setae on the dorsum of the posterior abdominal segments, usually two each on segments 6 and (or) 7 which are not present on any of the Micronesian specimens of *saipanensis.* Until Maskell's type can be located, or at least until additional Fijian and South Pacific material has been studied, it seems wise to apply Shiraiwa's name to the Micronesian specimens.

14. Dysmicoccus wistariae (Green).

Pseudococcus wistariae Green, 1923, Ent. Mo. Mag. **59**: 218.
Pseudococcus piricola Shiraiwa, 1935, Kontyu **9**: 69.
Pseudococcus cuspidatae Rau, 1937, Brooklyn Ent. Soc., Bull. **32**: 195.
Dysmicoccus cuspidatae: Ferris, 1950, Atlas Scale Ins. North America **5**: 61, fig. 20.
Dysmicoccus piricola: Takahashi, 1957, Osaka Prefecture, Bull. (B)**7**: 3.
Dysmicoccus wistariae: Williams, 1962, Brit. Mus. (Nat. Hist.) Ent. Bull. **12** (1): 23.

DISTRIBUTION: England (in glasshouses; type locality), United States, Japan, Gilbert Is.

GILBERT IS. BUTARITARI: Butaritari I., Dec. 1957, Krauss, on breadfruit.

HOSTS: Recorded from breadfruit in Micronesia. Elsewhere it has been taken on *Wisteria* (type host), *Taxus*, and pear.

Genus **Ferrisia** Fullaway

Ferrisia Fullaway, 1923, Hawaiian Ent. Soc., Proc. **5** (2) : 311.
Ferrisiana Takahashi, 1929, Nat. Hist. Soc. Formosa, Trans. **19** (104) : 429.

Type of genus: *Dactylopius virgatus* Cockerell.

Takahashi proposed *Ferrisiana* to replace *Ferrisia* Fullaway as he considered the latter to constitute a homonym of *Ferrissia* Walker, 1903 (Mollusca). As McKenzie (1962 : 638, footnote) has recently pointed out, Article 56a of the International Code of Zoological Nomenclature adopted by the XV International Congress of Zoology, published in 1961, specifically states that generic names differing in even one letter shall not be considered homonyms, hence the valid name is *Ferrisia*.

15. Ferrisia virgata (Cockerell).

Dactylopius virgatus Cockerell, 1893, Entomologist **26** : 178.
Pseudococcus virgatus: Ferris, 1919, Jour. Econ. Ent. **12** (4) : 297.
Ferrisia virgata: Fullaway, 1923, Hawaiian Ent. Soc., Proc. **5** (2) : 308.
Ferrisiana virgata: Takahashi, 1929, Nat. Hist. Soc. Formosa, Trans. **19** (104) : 429.—Zimmerman, 1948, Insects of Hawaii **5** : 271, fig. 144.—Ferris, 1950, Atlas Scale Ins. North America **5** : 93, fig. 35.—Beardsley, 1960, Hawaiian Ent. Soc., Proc. **17** (2) : 218, fig. 2, G (male).

DISTRIBUTION: Widespread in tropical and subtropical areas of the world (type locality: Jamaica), including Hawaii and Micronesia.

S. MARIANA IS. SAIPAN: Afenia (Afetna) Pt., June 1946, Townes, on *Alternanthera versicolor*; Experiment Station site, June 1946, Oakley, eggplant. TINIAN: Lake Hagoi (Hagoya), June 1946, Oakley, tomato; Camp Chulo (Churo), June 1946, Oakley, squash. GUAM: Piti, June 1911, Fullaway, *Annona muricata*; Mar. 1924, coconut leaves; April 1924, Evans, *Alocasia*; June 1937, Oakley, on mango; Talofofo, July 1937, Oakley on taro and cotton; Jan. 1938, Oakley, on *Leucaena glauca*; Dec. 1938, Oakley, on tomato vine; Feb. 1939, Oakley on *Pithecellobium dulce* pods; Inarajan, Feb. 1939, Oakley, on honeydew melon vine; Inarajan, March 1939, Oakley, on watermelon leaves; April 1939, Oakley, on *Leucaena glauca*; Northern Guam, April 1946, Krauss; Mt. Alifan, April 1946, Krauss, *Leucaena glauca*; Barrigada, April 1946, Krauss, on pineapple; Mt. Alifan, June 1946, Oakley, on *Caesalpinia*; Com. Mar. Hill, April 1948, Maehler, on *Plumeria acutifolia*; June 1957, Liming, on tomato.

PALAU. KOROR: March 1948, Maehler, on *Leucaena glauca*; Sept. 1952, Krauss, on *Leucaena glauca*; Feb. 1953, Beardsley, on *Leucaena glauca* and *Acalypha indica*.

YAP. YAP I.: Sept. 1948, Doutt; Dugor, Mar. 1949, Maehler, on

malvaceous plant; Kolonia, Mar. 1949, Maehler, on *Leucaena glauca*; April 1950, Langford; Kolonia, Mar. 1954, Beardsley, leaves of shower tree, *Cassia* sp.

TRUK. WENA (Moen): June 1946, Townes, on *Indigofera hirsuta*. TONOAS (Dublon): May 1946, Oakley, cotton. PIS: June 1946, Townes, *Plumeria acuminata*. TOTIU (Param): Mar. 1949, Potts, on soybean leaf.

PONAPE. Colonia, Aug. 1946, Oakley, *Annona muricata*; Colonia, Nov. 1953, Beardsley, dryland taro; Madolenihm, Nov. 1953, Beardsley, breadfruit leaves.

MARSHALL IS. AILINGLAPALAP: Bikajela (Bigatyelang) I., Aug. 1946, Townes, *Guettarda speciosa*. UJELANG: Ujelang I., Oct. 1953, Beardsley, on breadfruit leaves. RONGELAP: Rongelap I., Mar. 1963, Nishida, on squash. MAJURO: June 1950, Usinger; Uliga I., May 1950, Owen, and Oct. 1953, Beardsley, on *Acalypha* leaves. KWAJALEIN: April 1948, Maehler, on weed.

WAKE. PEALE I.: July 1940, T. Lyons, on *Diffenbachia*, tomato, and *Coccolobis uvifera*; 1938–39, Hadden, on *Coccolobis* leaves.

GILBERT IS. TARAWA: Aug. 1956, Brown, *Portulaca* roots; Banraeaba I., Nov. 1957, Krauss, *Lantana camara* leaves; Taborio I., Nov. 1957, Krauss, on *Morinda citrifolia* leaf.

HOSTS: *F. virgata* occurs on a wide variety of crop plants, ornamentals, and weeds. Breadfruit, coconut, mango, pineapple, taro, tomato, melons, squash, eggplant, and *Leucaena glauca* (=*L. leucocephala*) are among the more important reported hosts in Micronesia.

Takahashi (1936–1942) lists this species from Pagan, Saipan, Truk, and Wotje Atoll, on avocado, breadfruit, cassava, coffee, *Colocasia*, cotton, *Punica granatum*, and *Terminalia*.

Genus **Geococcus** Green

Geococcus Green, 1902, Ent. Mo. Mag. II, **13**: 262.

Type of genus: *Geococcus radicum* Green.

16. **Geococcus coffeae** Green.

Geococcus coffeae Green, 1933, Stylops **2**: 54.—Williams, 1958, Brit. Mus. (Nat. Hist.), Ent. Bull. **6** (8): 225, fig. 7.

Geococcus radicum: Fullaway, 1910, Hawaiian Ent. Soc., Proc. **2** (3): 108.—Zimmerman, 1948, Insects of Hawaii **5**: 158 (not *G. radicum* Green 1902).

DISTRIBUTION: Apparently widespread in tropical and subtropical areas of the world. It has been reported from Dutch Guiana (type locality), Ceylon, various locations in Africa, Hawaii, and Caroline Is.

PALAU. KOROR: July 1937, T. Yoshino, ex *Canna* roots.

TRUK. Ton (Tol): Mt. Unibot, Jan. 1953, Gressitt, ex Berlese funnel.

KUSAIE. Mt. Matante, 580 m., Feb. 1953, Clarke, ex duff from forest floor; Yela Cave, Mar. 1953, Clarke, floor of cave near entrance.

HOSTS: In Hawaii, *G. coffeae* has been found infesting roots of a number of hosts, including mango, coffee, pineapple, croton, *Caladium*, ferns, palms, and *Indigofera*. The only Micronesian host recorded is *Canna*, on roots.

This widespread hypogaeic species has been redescribed in detail and figured by Williams (1958 : 225, fig. 7), who also made a careful comparison between this species and the type material of *G. radicum* Green. Hawaiian records of *G. radicum* appear to represent misidentifications of *G. coffeae* as all Hawaiian *Geococcus* specimens which have been examined in the light of William's findings have proved to be *G. coffeae* (Beardsley, 1959).

Genus **Laminicoccus** Williams

Laminicoccus Williams, 1960, Brit. Mus. (Nat. Hist.), Ent. Bull. **8** (10) : 402.

Type of genus: *Tylococcus giffardi* Ehrhorn.

Two species of *Laminicoccus* are known from Micronesia. Unfortunately, one of these is represented in material at hand by but two fragmentary specimens, and it cannot be accurately placed at present.

Key to Micronesian Species of Laminicoccus

Circulus absent.....**pandani**
Circulus present.....**L.** species

17. Laminicoccus pandani (Cockerell), new combination.

Dactylopius pandani Cockerell, 1895, Psyche **7**, suppl. 1 : 16.

Pseudococcus pandani: Fernald, 1903, Cat. Coccidae of World, 107.

Tylococcus giffardi Ehrhorn, 1916, Hawaiian Ent. Soc., Proc. **3** (3) : 243, new synonymy.

Pseudococcus giffardi: Zimmerman, 1948, Insects of Hawaii **5** : 219, fig. 122.

Pseudococcus carolinensis Takahashi, 1939, Tenthredo **2** (3) : 245, new synonymy.

Laminicoccus giffardi: Williams, 1960, Brit. Mus. (Nat. Hist.), Ent. Bull. **8** (10) : 402.—Beardsley, 1960, Hawaiian Ent. Soc., Proc. **17** (2) :229, fig. 3,F (male).

DISTRIBUTION: Originally described from material from Washington I. (Uahuka), Marquesas group; the present known distribution also includes Tahiti, Fiji, Hawaii, and Micronesia (Gilbert, Marshall, and Caroline Islands).

CAROLINE ATOLLS. Eauripik: June 1958, N. Tellei, on *Pandanus*.

WOLEAI: Falalis I., Feb. 1953, Beardsley, and June 1958, N. Tellei, on *Pandanus*; Utegal I., July 1946, Oakley, on *Pandanus*. NOMWIN: Nomwin I., Feb. 1954, Beardsley, on *Pandanus*. LOSAP: Pis I., Oct. 1952, Beardsley, on *Pandanus*. KAPINGAMARANGI: Touhou I., July 1954, Niering, *Pandanus* leaf; Werua I., July–Aug. 1954, Niering, on *Pandanus*; Hare I., Aug. 1946, Oakley, on *Pandanus*. NUKUORO: Aug. 1946, Townes, on *Pandanus*.

TRUK. PIS: June 1946, Oakley, on *Pandanus tectorius*. WENA (Moen): Mar. 1949, Langford, on *Pandanus*.

PONAPE. Paliker-Colonia, Jan. 1938, Esaki, on *Pandanus*; Nanipil-Nanpohnmal, 65 m., Jan. 1953, Gressitt, on *Pandanus*; Nanpohnmal, Jan. 1953, Gressitt, on *Pandanus*.

MARSHALL IS. UJELANG: Ujelang I., Oct. 1953, Beardsley, on *Pandanus*. TARAWA: Taborio I., Nov. 1957, Krauss, on *Pandanus*; Abaokoro I., Oct. 1953, Beardsley, on *Pandanus*. KWAJALEIN: April 1948, Maehler, on *Pandanus*; May 1958, Gressitt, on *Pandanus*. LIKIEP: Likiep I., Aug. 1946, Oakley, on *Pandanus tectorius*.

GILBERT IS. BUTARITARI: Butaritari I., Dec. 1957, Krauss, on *Pandanus*. TARAWA: Taborio I., Nov. 1957, Krauss, on *Pandanus*; Abaokoro I., Dec. 1957, Krauss, on *Pandanus* leaves.

HOSTS: The only reported host of this mealybug in Micronesia is *Pandanus*. In Hawaii it has also been found infesting the climbing pandanus, *Freycinetia*.

The new synonymy cited above is the result of my examination of Cockerell's type of *Dactylopius pandani* which is now in the U.S. National Coccid Collection in Washington, D.C.; cotypes of Takahashi's *Pseudococcus carolinensis*; and material from Fiji, Hawaii, and Tahiti; in addition to the Micronesian collections cited above. Ehrhorn's type of *Tylococcus giffardi*, from Honolulu, apparently is lost. However, his description and the absence of any similar species in Hawaii leave little doubt as to the identity of his species.

The pandanus mealybug, a common name suggested by Zimmerman (1948 : 219) and now even more suitable in view of the above synonymy, has been redescribed and figured by Ferris (*In* Zimmerman 1948 : 219, fig. 122) under the name *P. giffardi*.

18. Laminicoccus sp.

DISTRIBUTION: Caroline Is. (Palau).

PALAU. KOROR: July 1956, McDaniel.

HOST: *Pandanus*.

Two fragmentary specimens are at hand from Koror, one on *Pandanus* and the second without host designation. The presence of a definite circulus in these specimens suggests that they may be allied to *L. vitiensis* (Green and Laing) and *L. cocois* Williams.

Genus **Neoripersia** Kanda

Neoripersia Kanda, 1943, Kansai Ent. Soc., Trans. **12**: 49.

Type of genus: *Ripersia ogasawarensis* of Kanda (= *R. japonica* Kuwana, not *R. agasawarensis* Kuwana).

This genus is separated from *Trionymus* by Takahashi in his key to Japanese mealybug genera (1957: 4) primarily on the basis of the structure of the hind coxae, which are "not thickened at the basal margin, with a plate extending to the venter of the body which is with many translucent pores; antennae and legs much reduced in size." According to Takahashi, Kanda's original description is based not on *R. ogasawarensis* Kuwana, the stated type of genus, but on material from the Ryukyu Islands (Amami-Oshima) which is identical with a species reported by Kuwana (Zool. Mag. Tokyo **43**: 163, 1931) as *Ripersia japonica*. Takahashi indicates (1957: 7) that he examined specimens of Kuwana's *R. ogasawarensis* (presumably from type material) and has assigned the species to *Neoripersia* Kanda.

Kanda's original description of *Neoripersia* indicates that the genus is characterized by complete absence of trilocular pores, although at least two species assigned to it by Takahashi (*Ripersia ogasawarensis* Kuwana and *Trionymus miscanthicola* Takahashi) have a few such pores associated with the cerarii. Other important characters of *Neoripersia* mentioned by Kanda are: antennae 6- or 7-segmented, usually 7-segmented; derm with large circular pores (multilocular disc pores) and small tubular ducts; at least two pairs of cerarii present with conical spines but without pores; ventral cicatrices (circuli) usually present (number not indicated), oval in shape. Kanda states that the genus "differs from *Trionymus* or *Erium* by absence of trilocular pores." He does not, however, mention the unusual condition of the hind coxae which is stressed by Takahashi. What appears to be a similar condition of the posterior coxae occurs in a new species from Palau here assigned to *Trionymus* on the basis of other characters. Borchsenius' figures of his *Kiritshenkella fushanensis* and *Cannococcus cannicola* (1960: 932, figs. 14 and 16) suggest a very similar condition of the hind coxae in those species. *Neoripersia* appears closely allied to *Kiritshenkella* Borchsenius, and quite possibly the latter should fall as a synonym. Unfortunately, it has not been possible for me to examine specimens of *Ripersia japonica* Kuwana, the type of *Neoripersia*, and the problem therefore remains unsettled.

19. Neoripersia ogasawarensis (Kuwana) (fig. 3).

Ripersia agasawarensis Kuwana, 1909, New York Ent. Soc., Jour. **17**: 161, pl. 10, figs. 1–3.

Neoripersia ogasawarensis: Takahashi, 1957, Univ. Osaka Pref., Bull. (ser. B) **7**: 7.

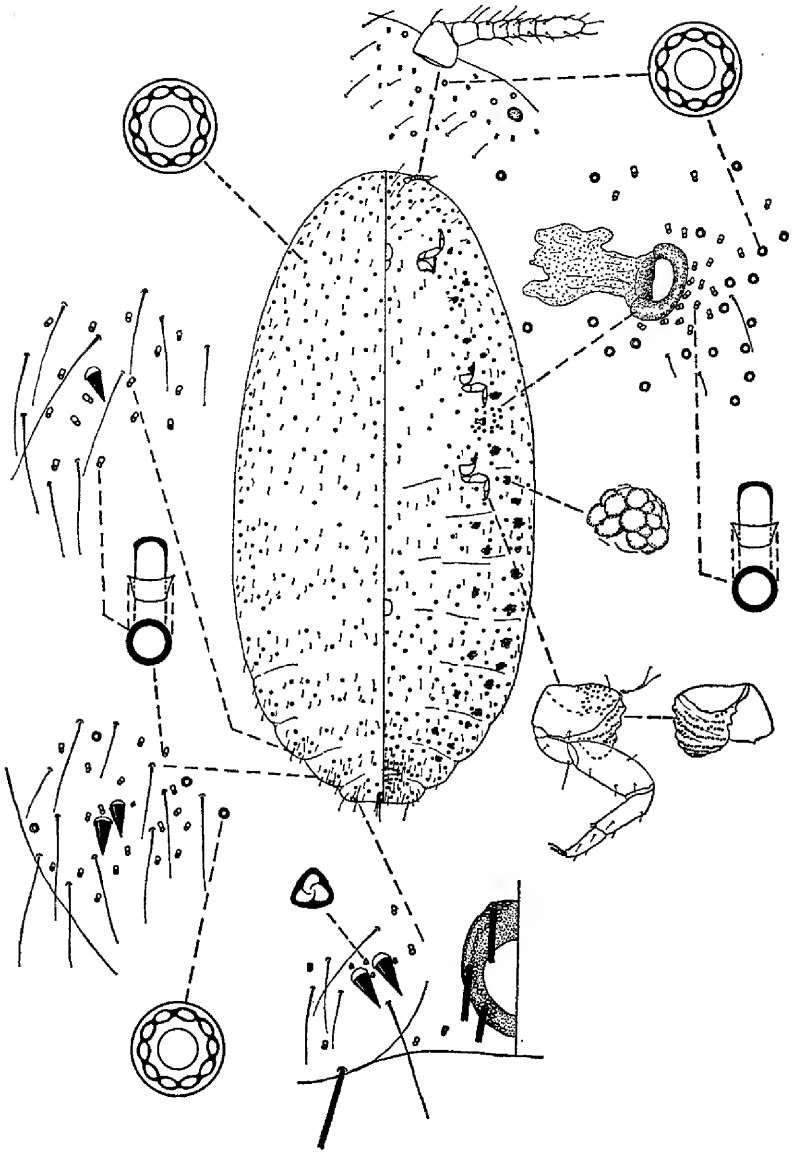

FIGURE 3.—*Neoripersia ogasawarensis*, dorsal and ventral aspects and details.

Adult female. Body elongate; maximum length of slide-mounted specimens about 5.0 mm. Anal lobes not appreciably protuberant. Antennae 7-segmented, very short, about 190 μ over all. Legs small; hind femur about 120 μ long, hind tibia about 90 μ long, hind tarsus about 52 μ long, hind tarsal claw 25 μ long. Hind coxae each with 35 to 50 translucent spots or micropores in lower (anterior) surface; upper or posterior basal margin confluent with an irregular, wrinkled, sclerotized area of ventral derm containing numerous (around 70 to 90) micropores similar to those of coxae. Remaining segments of hind legs without discernible micropores. Rostrum small, about 90 μ long. Dorsal ostioles not discernible; a single well-defined ventral circulus present; extending across fold between abdominal segments 4 and 5, about 120 μ long by 110 μ wide. Eyes small, about 20 μ diameter, without a sclerotized ocular cone.

With three pairs of lateral abdominal cerarii; anal lobe cerarii each with 2 conical setae about 22 μ long plus several elongate slender accessory setae about 75 μ maximum length; 3 or 4 trilocular pores present around bases of conical setae; the surrounding derm not noticeably sclerotized. Penultimate cerarii each with 2 conical setae about 20 μ maximum length plus several rather widely scattered slender accessory setae about 60 μ maximum length; trilocular pores absent, or not more than one or two discernible, around bases of conical setae; a few small shallow tubular ducts, of the type scattered over derm, present around bases of conical setae. Antipenultimate cerarii each represented by a single conical seta about 18–20 μ long, plus several scattered long slender setae, and scattered small tubular ducts. Venter of anal lobes without discernible sclerotized area; anal lobe seta about 150 μ long.

Small, shallow oral collar type tubular ducts, about 3 μ oral diameter by about 5–6 μ deep, scattered over both dorsum and venter, most numerous along lateral margins, relatively sparsely distributed on mid-dorsal and mid-ventral regions. Multilocular disc pores of usual type scattered over dorsum and venter, somewhat more concentrated on posterior part of venter around vulva, around spiracles, and along lateral margins. Trilocular pores absent, except for few associated with cerarii. Body clothed with scattered fine setae mostly 20–40 μ long; somewhat longer setae, up to about 75 μ in length, present around vulva and on venter of head anterior to mouthparts. Ventral derm with a longitudinal series of small areolate areas sublaterally on each side, extending from the anterior part of thorax to about abdominal segment 8; 2 to 4 such areolate areas usually discernible on each side of each segment, each area composed of an irregular group of around 10 to 15 small areolae.

DISTRIBUTION: Bonin Islands (type locality).

HOST: Recorded by Kuwana from *Miscanthus* sp.

This species is not represented in the available postwar collections.

Five adult female specimens, recently restained, which comprise the type series of *N. ogasawarensis*, were loaned for study by the National Institute of Agricultural Science, Nishigahara, Tokyo, Japan. All five are large, fully distended females which are either torn, badly wrinkled, or otherwise distorted or damaged. In view of the very incomplete nature of Kuwana's original description, a redescription and figure of this species are presented here, based upon the type series. The best of the five specimens has been designated a lectotype.

Takahashi's emendation is accepted as the proper transliteration, as the Japanese name for the Bonin Islands is "Ogasawara."

Genus **Neosimmondsia** Laing

Neosimmondsia Laing, 1930, Bull. Ent. Research **21**: 19.

Type of genus: *Neosimmondsia hirsuta* Laing.

20. Neosimmondsia esakii Takahashi.

Neosimmondsia esakii Takahashi, 1939, Tenthredo **2** (3) : 254, fig. 8.

DISTRIBUTION: Caroline Is. (Ponape). Endemic?

PONAPE. Nanipil-Nahnalaud (Nampil-Nanalaun), Jan. 1938, Esaki, on *Pandanus* (type material); Mt. Dolen Nankep (Dolennanlap), 240 m., Aug. 1946, Fosberg, on *Ponapea ledermanniana*; Ngihneni (Ninani), Aug. 1950, Adams.

HOSTS: *Pandanus* and native palm (*Ponapea*).

This species differs from the type of the genus in that it possesses a continuous fringe of very long conical setae entirely around the lateral margins of the body. No definite cerarii are present, however. The rotund body shape, the 6-segmented antennae, and the relatively large coxae, particularly those of the posterior pair of legs, appear to relate this species to *N. hirsuta*, although the latter lacks both cerarii and the conspicuous marginal fringe of long conical spines characteristic of *N. esakii*.

Genus **Palaucoccus,** new genus

Type of genus: *Palaucoccus gressitti*, new species.

Recognition characters: Body elongate-oval; anal lobes not strongly developed. Antennae 7-segmented in known species. Legs normally developed, of moderate size, tarsal claw without a denticle on inner face. Anal ring at posterior apex of dorsum cellular, bearing 6 relatively short setae, shorter than ring. Spiracles normal. Two pairs of dorsal ostioles present; circulus absent in known species. Without definite cerarii; dorsum of anal lobes entirely membranous, with a few moderately long, slender setae, but without conical setae or a concentration of trilocular pores. Venter of anal lobe with a narrow, elongate area of sclerotization extending anteriorly from base of anal-lobe seta. Dorsum with a few oral-rim tubular ducts; venter with multilocular disc pores and oral-collar ducts; trilocular pores moderately numerous on both dorsum and venter; without paraocular discoidal pores or microducts associated with bases of hind coxae.

With regard to its affinities with other genera, *Palaucoccus* is something of an enigma. On one hand, the barlike sclerosis on the venter of the anal lobes suggests a possible relationship to *Planococcus* Ferris and its allies, except that all known genera of this group have well-developed cerarii (see Ezzat and McConnell, 1956). On the other hand, the complete absence of cerarii and the presence of a few oral-rim tubular ducts on the dorsum suggests a similarity to *Chorizococcus* McKenzie. *Palaucoccus* also shows some similarity to species placed in the genus *Atrococcus* Goux by Williams (1962), particularly in the possession of a small group of oral-collar ducts and multilocular disc pores on the lateral margins of the prothorax in the type species. However, species assigned to *Atrococcus* all have numerous oral-rim tubular ducts and at least one pair of cerarii. It is hoped that the eventual discovery of additional species allied to the type of *Palaucoccus* will shed light on its relationship to other genera.

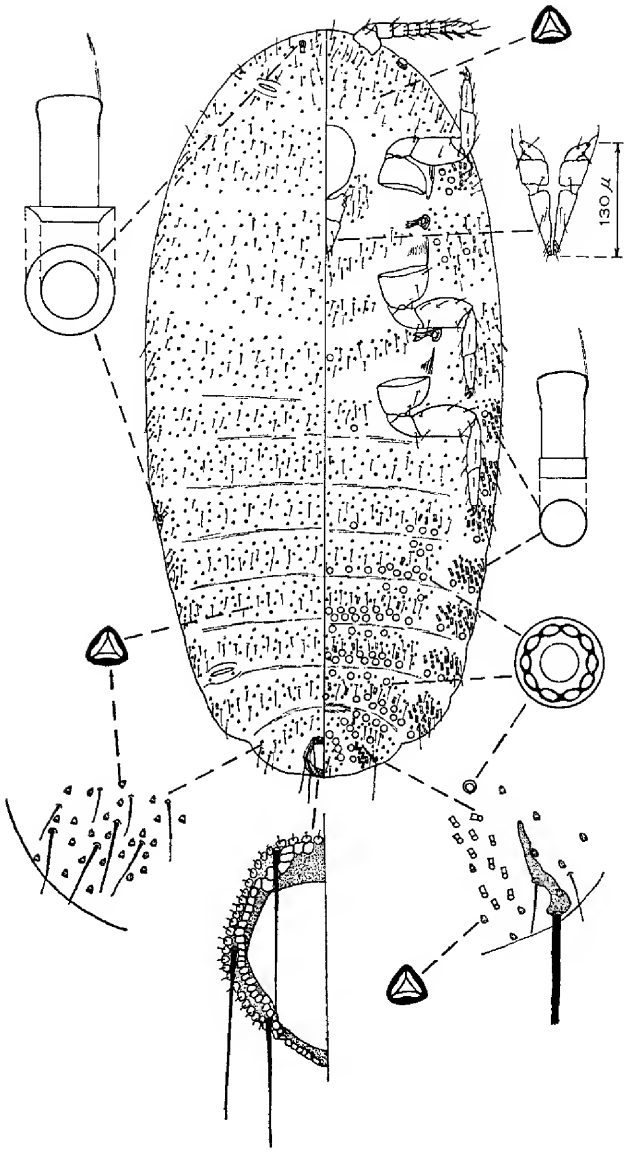

FIGURE 4.—*Palaucoccus gressitti*, adult female, dorsal and ventral aspects and details.

21. Palaucoccus gressitti Beardsley, n. sp. (figs. 4; 26, *b*).

Female. Small; length of slide-mounted specimen about 1.7 mm.; body form elongate-oval; anal lobes hardly protuberant. Antennae 7-segmented, about 240 μ long. Legs moderately small; hind femora about 125 μ long; hind tibiae about 110 μ long; hind coxae with 25–30 micropores, other segments without discernible micropores (fig. 26, *b*). Rostrum about 130 μ long. Anal ring cellular, about 90 μ wide, bearing 6 short setae about 80 μ maximum length. Two pairs of dorsal ostioles, their lips unsclerotized. Circulus absent. Eyes small, about 16 μ diameter, with a moderately well-developed ocular cone; paraocular discoidal pores absent.

Cerarii completely wanting; dorsum of anal lobes with a few moderately slender setae about 30 μ in length, unsclerotized. Venter of anal lobe with a narrow, elongate sclerotized area extending anteriorly from base of anal lobe seta. Anal lobe seta about 80 μ long.

Dorsal oral-rim tubular ducts limited to 2 in the unique type, each about 7–8 μ diameter across rim; one on head, approximately over the base of one antenna; second laterally on margin of abdominal segment 4; position and number of dorsal tubular ducts probably variable. Venter with a marginal band of oral-collar tubular ducts, about 3–4 μ diameter, on each side; 8 to 20 such ducts on each side of abdominal segments 2 to 8; a few such ducts (6 to 8 in type) along posterior margin of venter of segment 9; a few additional oral-collar ducts on lateral margins of each segment of thorax; and forming a sparse transverse row on abdominal segments 6 to 8; plus a few sublaterally on segments 4 to 5. Multilocular disc pores confined to venter, distributed in transverse rows across posterior margins of abdominal segments 4 to 9; and on anterior margins of abdominal segments 5 to 9; a few scattered on venter of thorax and basal segment of abdomen; 3 or 4 on each side of pro- and mesothorax, associated with a few oral-collar ducts. Trilocular pores moderately densely scattered on dorsum and venter. Body sparsely clothed with fine setae; those of both dorsum and venter about the same length, around 30 μ maximum. Setae on venter of head anterior to mouthparts not appreciably longer.

Holotype, female (US 67967), E. Ngatpang, Babelthuap, Palau Is., 65 m., Dec. 1952, Gressitt.

DISTRIBUTION: Caroline Is. (Palau).

HOSTS: Unknown.

Genus **Palmicultor** Williams

Palmicultor Williams, 1963, Entomologist **96**: 100.

Palmicola Williams, 1960, Brit. Mus. (Nat. Hist.) Ent. Bull. **8** (10): 415 (preoccupied).

Type of genus: *Ripersia palmarum* Ehrhorn.

Two Micronesian species are here assigned to this genus; one of them is described as new.

Key to Known Micronesian Species of Palmicultor

Antennae 7- or 8-segmented; anal lobe cerarii each with but two conical setae, borne on a moderately well-developed sclerotized area; very short, small tubular ducts scattered on dorsum and venter, particularly evident along lateral margins. **guamensis**

Antennae 6-segmented; anal lobe cerarii usually with more than two conical setae, surrounding derm not discernibly sclerotized; tubular ducts of the type described above absent, although a few very small, more elongate ducts are present anterior to vulva, and a few somewhat larger ducts along lateral margins of head. . . **palmarum**

22. Palmicultor guamensis Beardsley, n. sp. (fig. 5).

Female. Body form moderately broadly oval; about 2 mm. long on slide. Antennae 7- or incompletely 8-segmented, 280 to 300 μ over-all length. Legs moderately small; hind femora about 170 μ long; hind tibiae about 125 μ long, the apical spines not strongly developed. Micropores of hind legs few, 6 to 10 discernible in upper surface of hind coxae, around 12 in upper surface of hind tibiae, apparently wanting in remaining segments. Numerous micropores in ventral derm surrounding attachment of metacoxae. Rostrum about 120 μ long. Anal ring cellular, about 87 μ wide, bearing 6 setae about 140 μ maximum length. Two pairs of dorsal ostioles present, rather small but with the lips moderately sclerotized as in other species of this genus. Circulus moderately large, extending across intersegmental line between abdominal segments 4 and 5. Eyes rather small, about 18 μ diameter; ocular cone weakly developed. With 17 pairs of marginal cerarii; most cerarii with 2 conical setae of about equal size; an occasional cerarius on head, thorax, or anterior part of abdomen with but 1 such conical seta or with 3; penultimate and other posterior cerarii sometimes with a third much smaller conical seta. Anal lobe cerarii each with 2 conical setae about 20 μ long, 5 or 6 slender accessory setae about 75 μ maximum length, plus a few trilocular pores, not strongly concentrated, and borne on an area of weak sclerotization. Penultimate cerarii each with 2 conical setae nearly as large as those of the anal lobe cerarii (about 18 μ long) plus usually 1 smaller conical seta about 12 μ long and a few slender accessory setae and a few trilocular pores; surrounding derm unsclerotized. Conical setae of anterior cerarii becoming slightly smaller anteriorly, mostly 14–18 μ long. Venter of anal lobes unsclerotized; anal lobe setae each about 150 μ long.

Tubular ducts of two types: a few very fine (oral diameter about 2 μ) elongate oral-collar type ducts midventrally on abdominal segments caudad of the circulus; larger diameter, extremely shallow oral-collar tubular ducts, about 4 μ diameter at orifice by about 3 μ deep, sparsely distributed over both dorsum and venter, particularly noticeable along lateral margins. Multilocular disc pores present on both dorsum and venter, present on all segments of the dorsum except sometimes on segment 9; slightly more concentrated around the vulva ventrally. Trilocular pores moderately densely distributed on dorsum and venter, relatively sparse on venter of posterior abdominal segments. Dorsum and venter moderately densely clothed with fine setae; those of dorsum mostly 35–55 μ long, with a few longer ones, up to about 65 μ long, near lateral margins of abdominal segments; ventral setae mostly 30–60 μ long, a few longer ones, up to about 80 μ long, around vulva.

Holotype, female (US 67968), and 2 paratypes on one slide, Merizo, Guam, S. Mariana Is., June 1946, Oakley, on *Cocos nucifera*. Twelve paratypes (US, BISHOP) on 5 slides, same data as holotype.

DISTRIBUTION: S. Mariana Is. (Guam).

HOST: Coconut.

This species has fewer conical setae in the cerarii than does the related *P. palmarum*. The antennae of the latter species are consistently 6-segmented, whereas in *P. guamensis* they are 7- or incompletely 8-segmented, although additional specimens may show this character to be variable. *P. guamensis* differs from both *P. palmarum* and *P. browni* Williams, the only other species now assigned to *Palmicultor*, in having the anal lobe cerarii borne on somewhat sclerotized areas, and in the possession of peculiar small, shallow tubular ducts scattered over the body. These ducts resemble closely those present in species I have assigned to the new genus *Pandanicola*, suggesting a possible relationship between that genus and *Palmicultor*.

Palmicultor guamensis differs further from *P. palmarum* in the possession

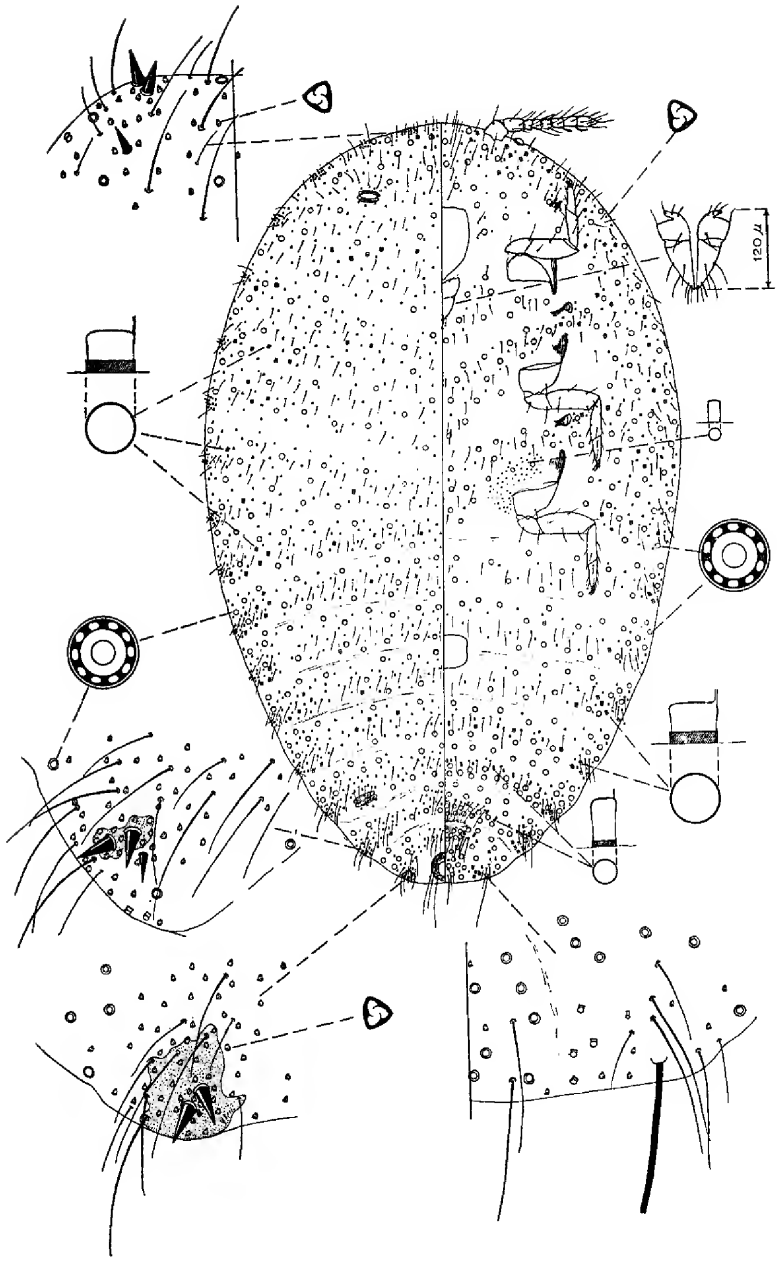

FIGURE 5.—*Palmicultor guamensis*, adult female, dorsal and ventral aspects and details.

of a greater number of dorsal multilocular disc pores, but in view of the variable number of such pores encountered in specimens assigned to *P. palmarum* (see below) this point should perhaps not be overemphasized.

23. Palmicultor palmarum (Ehrhorn).

Ripersia palmarum Ehrhorn, 1916, Hawaiian Ent. Soc., Proc. **3** (3) : 245.

Pseudococcus oceanicus Takahashi, 1939, Tenthredo **2** (3) : 239; new synonymy.

Pseudococcus oceanicus var. *kentiae* Takahashi, 1939, Tenthredo **2** (3) : 242; new synonymy.

Pseudococcus palmarum: Zimmerman, 1948, Insects of Hawaii **5** :235, fig. 130.

Palmicola palmarum: Williams, 1960, Brit. Mus. (Nat. Hist.) Ent. Bull. **8** (10) : 415.—Beardsley, 1960, Hawaiian Ent. Soc., Proc. **17** (2) : 232, fig. 3, J (male).

Palmicultor palmarum: Williams, 1963, Entomologist **96** : 100.

DISTRIBUTION: Hawaii (type locality), Canton I., Malaya (Williams, 1960), Philippines (?), Micronesia.

PALAU. KOROR: Aug. 1958, Tellei, on coconut leaves and flowers; Aug. 1958, Owen, on croton (host record questionable). NGERKABESANG (Arakabesan): Aug. 1953, Beardsley, on coconut. PELELIU: July 1946, Oakley, on coconut.

YAP. YAP: Aug. 1950, Goss, on coconut. E. MAP: Aug. 1950, Goss, on betel nut, *Areca catechu.*

CAROLINE ATOLLS. PULO ANNA: Sept. 1952, Krauss, on coconut leaf. NGULU: Ngulu I., Oct. 1952, Krauss, on coconut plant. ULITHI: Fassarai I., July 1946, Oakley, on *Cocos nucifera.* LAMOTREK: Lamotrek I., Feb. 1953, Beardsley, on *Cocos nucifera.* NOMWIN: May 1946, Townes, on *Cocos nucifera.* KAPINGAMARANGI: Hare I., Aug. 1946, Townes, on *Cocos nucifera.*

TRUK. WENA (Moen): June 1946, Townes, on *Cocos nucifera.* FEFAN: May 1946, Townes, on *Coelococcus amicarum.* TONOAS: Erin, Nov. 1937, Esaki, on coconut.

PONAPE. Madolenihm (Matalanum) Plantation, Dec. 1948, Langford, on coconut.

KUSAIE. Aug. 1946, Oakley, on coconut; Lele I., Aug. 1946, Oakley, on coconut.

MARSHALL IS. KWAJALEIN: Ebeye I., Mar. 1945, Wallace, coconut leaf. LIB: Lib I., Oct. 1953, Beardsley, on coconut leaf. AILINGLAPALAP: Ailinglapalap I., Aug. 1946, Oakley, on *Cocos nucifera.* JALUIT: Imroj I., Nov. 1937, Esaki, on coconut; Majurirok (Elizabeth) I., Sept. 1953, Beardsley, on coconut. NAMORIK: Namorik I., Sept. 1953, Beardsley, on coconut.

LIKIEP: Likiep I., Aug. 1946, Oakley, on coconut. MAJURO: Telap (Dalap) I., Aug. 1946, Townes, on *Cocos nucifera*; "Laura" I., Aug. 1946, Townes, on *Cocos nucifera*; Uliga I., Nov. 1953, Beardsley, on coconut foliage.

GILBERT IS. TARAWA: Aug. 1956, Brown, on coconut.

PHOENIX IS. CANTON I.: Sept. 1950, Krauss, on coconut.

HOSTS: Various palms; nearly all Micronesian records are from coconut. The record from Koror, on croton, will be considered doubtful until verified.

Takahashi (1939), in describing *P. oceanicus*, called attention to the numerous minute pores in the ventral derm around the bases of the hind coxae; and Williams (1960) stressed this character in his definition of the genus *Palmicola*. Although neither Ehrhorn nor Ferris (*In* Zimmerman, 1948 : 235, fig. 130) mention these pores in their treatments of *P. palmarum*, they are present in all Hawaiian specimens which I have examined. Comparison of Hawaiian material with cotypes of Takahashi's *P. oceanicus* and its variety *kentiae* has resulted in the new synonymy cited above.

The number and distribution of multilocular disc pores seems quite variable in this species. In the specimens at hand, these pores are always present on the venter, scattered over the entire surface as indicated in Ferris' (1948) figure. Frequently multilocular disc pores are present also on the dorsum, particularly on the anterior part of the body. In the material studied the number of dorsal multiloculars ranges from none, to one or two discernible, to a few on head and thorax as in Takahashi's *P. oceanicus* material, to relatively numerous, although none of the specimens have as many dorsal multiloculars as do the available specimens of *P. guamensis*. The Hawaiian material which I have seen shows a similar range of variability in the number of dorsal multilocular pores present.

Ferris (1948) states that tubular ducts of any kind appear to be lacking in this species. Takahashi (1939) makes a similar statement concerning his *P. oceanicus*, here considered a synonym of *P. palmarum*. In all the material which I have examined, both Micronesian and Hawaiian, there are present a few very tiny (oral diameter about 2 μ) elongate tubular ducts on the venter just anterior to the vulva, and sometimes there are one or two slightly larger (oral diameter about 4 μ) tubular ducts associated with the cerarii of abdominal segments 5 to 7, and occasionally elsewhere along the lateral margins of the body, particularly near the eyes. The number of cerarii is also somewhat variable, there being between 14 and 17 discernible pairs in specimens at hand. Generally, one or more of the cerarii of the thorax and (or) head is either reduced to a single conical seta or is wanting.

Genus **Pandanicola,** new genus

Type of genus: *Trionymus pandani* Takahashi.

Recognition characters: Body form elongate oval; anal lobes weakly developed; antennae 6- or 7-segmented. Cerarii numbering 17 or fewer marginal pairs (6 to 17 pairs in known

species), anal lobe cerarii each with 2 conical setae, anterior cerarii each with 1 to 3 such setae, those of head and thorax sometimes reduced or wanting, most cerarii with from 1 to several slender accessory setae; derm surrounding all cerarii unsclerotized. Dorsal ostioles present or absent; circulus present or absent. Trilocular pores relatively few, usually present, laterally associated with cerarii, sometimes sparsely scattered over body. Multilocular disc pores numerous, scattered over both dorsum and venter. Tubular ducts of a peculiar small, very shallow form, present particularly along the lateral margins. Derm around bases of hind coxae without concentrations of minute tubular ducts. Legs moderately small; tarsal claws without a denticle on inner face; posterior legs without micropores in any of the segments. Anal ring at posterior apex of body, cellular, with 6 anal ring setae.

The distinctive features of this genus are the unusually shallow, small tubular ducts; the presence of multilocular disc pores scattered on both dorsum and venter, the reduced number of trilocular pores; and the absence of micropores in the hind legs. The shallow tubular ducts and the greater number of cerarii (6 or more pairs) will serve to separate *Pandanicola* from *Trionymus*, and the former character will separate it from *Dysmicoccus*. The absence of a concentration of minute tubular ducts in the ventral derm at the base of the hind coxae will distinguish *Pandanicola* from *Palmicultor*. The latter genus contains at least one species (*P. guamensis*) having shallow tubular ducts similar to those found in *Pandanicola*.

Key to Known Species of Pandanicola

Circulus and dorsal ostioles present; normally with 16 or 17 pairs of cerarii; with a few scattered trilocular pores on dorsum and venter; Palau.....**esakii**

Circulus and dorsal ostioles absent, normally with 6–10 pairs of marginal cerarii; trilocular pores reduced to a very few along the lateral margins, mostly associated with cerarii; Ponape.....**pandani**

24. Pandanicola esakii (Takahashi), new combination.

Pseudococcus esakii Takahashi, 1942, Tenthredo 3 (4) : 340.

DISTRIBUTION: Caroline Is. Endemic?

PALAU. Babelthuap: Cacao Plantation near Imeliik, Aug. 1953, Beardsley, on *Freycinetia* sp.

HOSTS: Pandanaceae (*Pandanus* and *Freycinetia*).

Takahashi's type material from Palau has not been available for study, but material at hand from the type locality agrees in most essential details with the original description, and is here placed as *P. esakii*.

Takahashi states that tubular ducts are absent in this species. However, all the specimens at hand possess small, very shallow, tubular ducts very similar to, but slightly larger than, those found in *P. pandani*, and it may safely be assumed that Takahashi overlooked these structures in *P. esakii* as he did in the former species. It is likely that the "larger nearly triangular pores present on lateral and posterior marginal areas" to which Takahashi refers are actually these tubular ducts, possibly viewed obliquely. The specimens available possess 16 or 17 pairs of cerarii, the pair just dorsad of the eyes frequently being reduced to one or two spinelike setae, or wanting.

25. Pandanicola pandani (Takahashi), new combination (figs. 6; 26, *a*).
Trionymus pandani Takahashi, 1939, Tenthredo **2** (3) : 250.

DISTRIBUTION: Caroline Is. (Ponape). Endemic?
HOST: *Pandanus*.

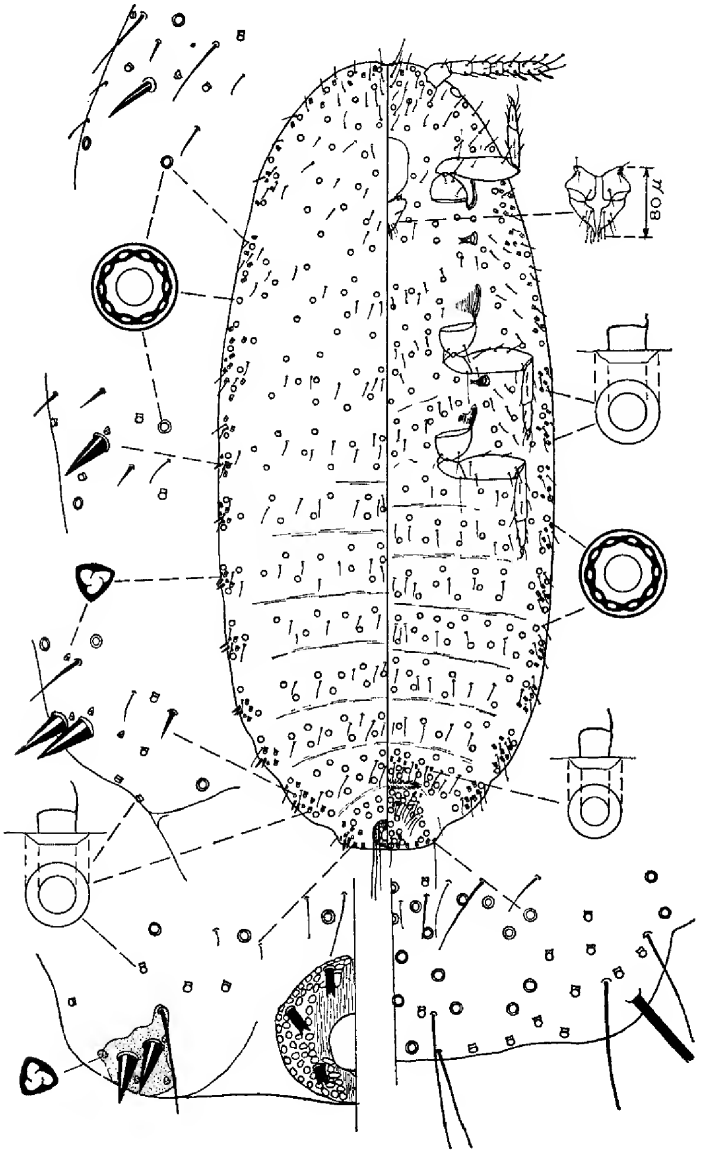

FIGURE 6.—*Pandanicola pandani*, adult female, dorsal and ventral aspects and details.

Takahashi's type material, obtained on loan from the Taiwan Agricultural Research Institute, consists of two slides each labeled "(Caroline Isls.) Ponape: Nipit-ninoani, 13.i.1938, T. Esaki" on one label and "*Trionymus pandani* Takah. Host: Pandanus (cotypes)" on the other. These two slides contain a total of 24 specimens. To study the material critically, 15 specimens on one slide were removed, restained, and remounted on 6 slides. One specimen among these has been designated a lectotype, and the remaining 23 cotype specimens designated paratypes. This species is not represented in the post-World War II collections.

Most of Takahashi's specimens possess 8 to 10 recognizable cerarii; those of the anterior abdominal and thoracic segments frequently represented by a single conical seta or sometimes an elongate spinelike seta. Takahashi states that tubular ducts of any kind are wanting in this species, but he apparently failed to note the very small, shallow tubular ducts which are present both dorsally and ventrally along the lateral margins.

Genus **Paraputo** Laing

Paraputo Laing, 1929, Ann. Mag. Nat. Hist. X, **4**: 473.

Type of genus: *Paraputo ritchiei* Laing (= *Ripersia anomala* Newstead).

26. Paraputo leveri (Green) (figs. 7; 21, *b*).

Pseudococcus leveri Green, 1934, Ann. Mag. Nat. Hist. X, **13**: 473, fig.

Paraputo leveri: Williams, 1960, Brit. Mus. (Nat. Hist.) Ent. Bull. **8** (10): 421, fig. 16.

DISTRIBUTION: Fiji Is., Solomon Is., Caroline Is.

CAROLINE ATOLLS. TOBI: Sept. 1952, Krauss, on injured coconut trunk.

HOST: Coconut.

The accompanying figure is based on Micronesian material. Williams' (1960) figure does not clearly indicate the long setae, up to about 110 μ in length, which surround the anal ring dorsally, or the micropores which are present in the hind femora and tibiae as well as the hind coxae (see fig. 21, *b*). However, Dr. Williams informs me (personal communication) that such pores are present on specimens of *P. leveri* in the British Museum. Dr. Williams kindly compared Micronesian specimens with authentic *P. leveri* specimens in the British Museum and has provided me with fresh material of this species from Fiji and the Solomon Is. We both agree that the Micronesian specimens should be placed as this species.

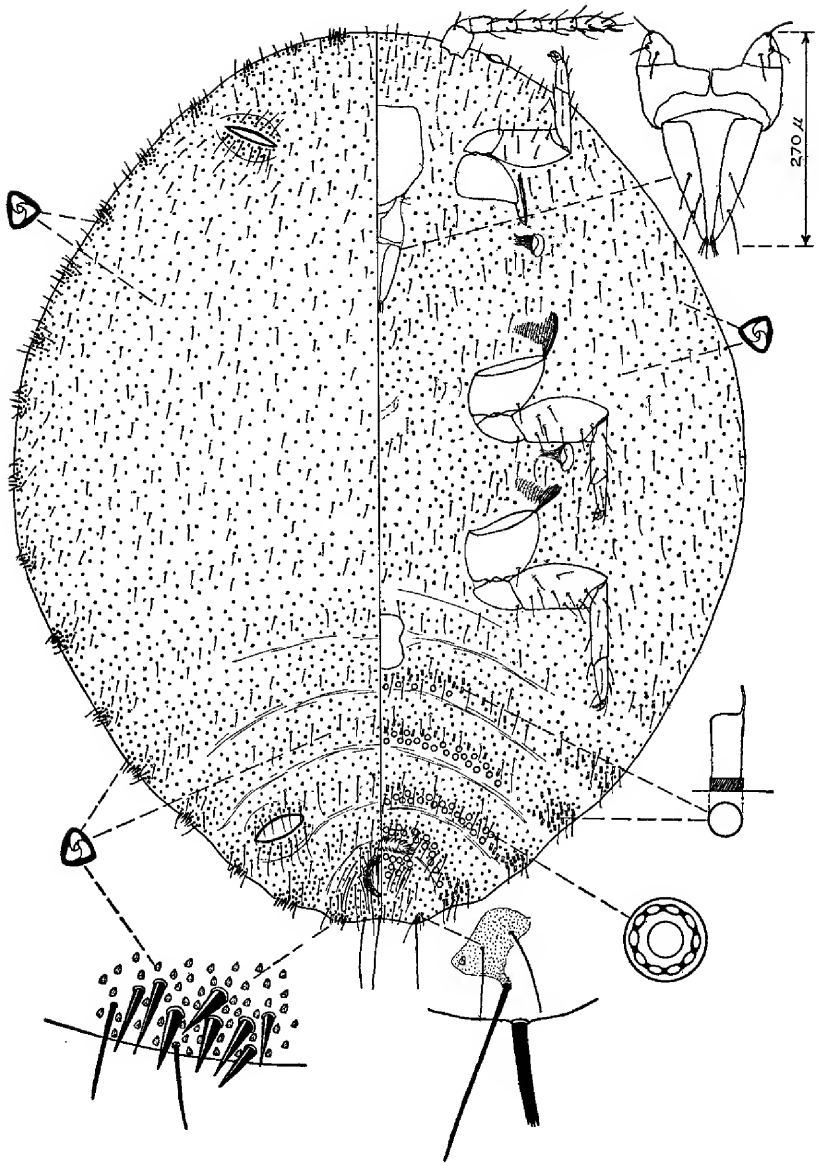

FIGURE 7.—*Paraputo leveri*, adult female, dorsal and ventral aspects and details.

Genus **Phenacoccus** Cockerell

Phenacoccus Cockerell, 1893, Ent. News **4**: 318.

27. Phenacoccus solani Ferris.

Phenacoccus solani Ferris, 1918, Stanford Univ. Pub. (Univ. Series) **32**: 60, pl. 2, fig. 22.—Zimmerman, 1948, Insects of Hawaii **5**: 165, fig. 96.—Ferris, 1950, Atlas Scale Ins. North America **5**: 158, fig. 61.

DISTRIBUTION: Puerto Rico, southern and western United States, Hawaii, Marshall Is., Gilbert Is.

MARSHALL IS. ENIWETOK: Enjebi (Engebi) I., May 1946, Townes, on *Wedelia biflora*. KWAJALEIN: Kwajalein I., Nov. 1957, Krauss, on *Messerschmidia*.

GILBERT IS. TARAWA: Aug. 1956, Brown, on *Portulaca* roots; Bairiki I., Nov. 1957, Krauss, on young leaves of *Messerschmidia*; Banraeaba I., Nov. 1957, Krauss, on *Scaevola* leaves.

HOSTS: Recorded from a long list of hosts in the United States. The Micronesian host records, *Wedelia*, *Messerschmidia*, *Portulaca*, and *Scaevola*, include no plants of economic importance.

It appears likely that this species was introduced accidentally into Micronesia from either Hawaii or the United States during or shortly after World War II. Extensions of its range in Micronesia are to be expected.

Genus **Planococcus** Ferris

Planococcus Ferris, 1950, Atlas Scale Ins. North America **5**: 164.—Ezzat and McConnell, 1956, Univ. Maryland Agric. Expt. Sta., Bull. A-**84**: 60.

Type of genus: *Dorthesia citri* Risso.

KEY TO KNOWN MICRONESIAN SPECIES OF PLANOCOCCUS

Legs relatively slender, hind pair with less numerous, larger micropores on coxae and tibiae (fig. 8, *b*); cisanal setae never longer than anal ring setae (fig. 8, *a*).....**citri**

Legs relatively stout, hind pair with more numerous, smaller micropores on coxae and tibiae (fig. 8, *d*); cisanal setae longer than anal ring setae (fig. 8, *c*).....**lilacinus**

28. Planococcus citri (Risso) (fig. 8, *a*, *b*).

Dorthesia citri Risso, 1813, Ann. Mus. Hist. Nat. Paris **30**: 416 (not seen).

Dactylopius citri: Signoret, 1875, Ent. Soc. France, Ann. V, **5**: 312.

Pseudococcus citri: Fernald, 1903, Cat. Coccidae of World, 99.—Zimmerman, 1948, Insects of Hawaii **5**: 206, fig. 114.

Planococcus citri: Ferris, 1950, Atlas of Scale Ins. North America **5**: 165.—Ezzat and McConnell, 1956, Univ. Maryland Agric. Expt. Sta. Bull. A-**84**: 65, fig. 21.—Beardsley, 1960, Hawaiian Ent. Soc., Proc. **17** (2): 224, fig. 3, *a* (male).

DISTRIBUTION: Nearly cosmopolitan (type locality: Southern France).

S. MARIANA IS. SAIPAN: June 1946, Oakley, on coffee and *Guamia*; "Magacienne Bay," Feb. 1949, Maehler, on *Eugenia stelechantha*; Chalan Kanoa, Feb. 1958, Krauss, croton leaves. GUAM: Nimitz Hill, Feb. 1958, Krauss, on guava leaves.

PALAU. BABELTHUAP: July 1946, Oakley, on *Annona muricata*. KOROR: Mar. 1948, Maehler, on pomelo (*Citrus paradisi*) and soursop (*Annona muricata*); Jan. 1953, Beardsley, on *Gardenia* leaves, guava leaves, and

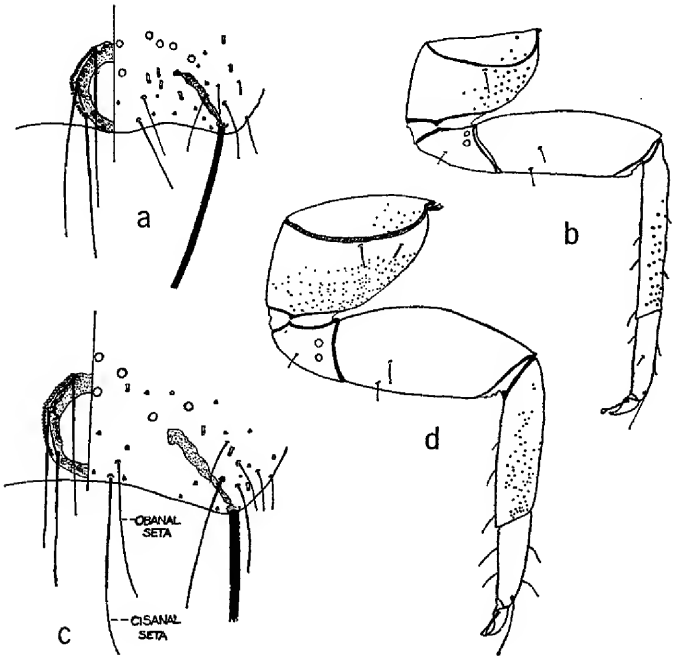

FIGURE 8.—**a, b**, *Planococcus citri*: *a*, dorsal and ventral aspects of posterior end of abdomen; *b*, upper surface of hind leg showing distribution of micropores. **c, d**, *P. lilacinus*: *c*, dorsal and ventral aspects of posterior end of abdomen; *d*, upper surface of hind leg showing distribution of micropores.

tomato foliage; July 1953, Beardsley, on soursop; Sept. 1953, Beardsley, on rose; Jan. 1954, Beardsley, on croton, *Mimosa pundica*, *Impatiens*, and *Jatropha gossypifolia*; Aug. 1958, Owen, on croton.

YAP. YAP: April 1950, Langford; Tomil Dist., July 1950, Goss; central portion, Aug. 1950, Goss, on soursop (*Annona muricata*); Sept. 1952, Krauss; Kolonia, Mar. 1954, Beardsley, on leaves of shower tree (*Cassia* sp.); May 1958, Tellei, on soursop fruit.

CAROLINE ATOLLS. ELATO: Elato I., Sept. 1953, Krauss, on unidentified shrub.

TRUK. WENA (Moen): May 1946, Townes, on *Nipa fruticans*; Civil Administration area, Mar. 1949, Potts, on breadfruit. TONOAS (Dublon): May 1946, Oakley, on cotton; Feb. 1948, Maehler, on *Annona muricata*. TON (Tol): May 1946, Oakley, on orange, lime fruit, and pumpkin leaves; Mt. Unibot, Feb. 1953, Gressitt.

PONAPE. Colonia, Aug. 1946, Oakley, on *Coffea robusta*; Feb. 1948, Dybas, on frangipani leaf (*Plumeria*); July 1949, Owen, on *Psidium* sp.; Experiment Station (near Colonia), Sept. 1950, Adams; in quarantine at Guam, Dec. 1952, Liming, on citrus; Mt. Temwetemwensekir (Tamatamansakir), 180 m., Gressitt, on large ginger fruit; Palikir, Nov. 1953, Beardsley, on cacao fruit; Madolenihm, Nov. 1953, Beardsley, on *Derris*.

KUSAIE. Lele, Aug. 1946, Oakley, on orange; Malem, Feb. 1953, Clarke, on *Messerschmidia*.

MARSHALL IS. KWAJALEIN: Kwajalein I., June 1958, Owen, on *Aralia* leaves.

GILBERT IS. BUTARITARI: Butaritari I., Dec. 1957, Krauss, on breadfruit leaves. TARAWA: Bairiki I., Nov. 1957, Krauss, on breadfruit leaves.

HOSTS: The citrus mealybug has been reported from a great variety of host plants throughout its range. Among the economic plants of Micronesia it has been taken on breadfruit, cacao, various kinds of citrus, coffee, guava, pumpkin, soursop, and tomato. Takahashi (1936–1942) records *P. citri* from Saipan, Yap, Palau, Truk, and Ponape on *Annona*, betel palm, citrus, cotton, croton, and *Macaranga*.

29. Planococcus lilacinus (Cockerell) (fig. 8, *c*, *d*).

Pseudococcus lilacinus Cockerell, 1905, Davenport Acad. Sci., Proc. **10**: 128.

Planococcus lilacinus: Ezzat and McConnell, 1956, Univ. Maryland Bull. A-**84**: 89, fig. 32.

DISTRIBUTION: Madagascar, Mauritius, India, Ceylon, Java, Philippine Is. (type locality), Mariana Is., Caroline Is.

S. MARIANA IS. GUAM: Piti, June 1911, Fullaway, on orange; Sept. 1911, Fullaway, on citrus; Dec. 1911, Fullaway, on guava; Alifan, May 1936, Swezey, on seeded breadfruit; Mt. Alifan, June 1936, Swezey, on *Ficus*; Aug. 1937, Oakley, on *Premna gaudichaudi* and *Annona* sp.; Feb. 1938, Oakley, on orange; Agat, June 1938, Oakley on *Pandanus*; Inarajan, Sept. 1938, Oakley, on *Terminalia catappa*; Talofofo, April 1946, Krauss; Mt. Alutom, June 1946, Townes, on *Flagellaria indica*; 1 m. southeast of Asan, Nov. 1947, Dybas; Talofofo, Dec. 1947, Maehler, on *Bauhinia variegata*; Feb. 1948, Maehler, on unidentified plant; Umatac, Feb. 1948,

Maehler, on *Erythrina* sp.; Com. Mar. Hill, Dec. 1948, Maehler, on *Plumeria acutifolia*; Agana, Oct. 1952, Krauss, on *Ficus* stems and guava leaves; Nov. 1953, Liming, on *Bauhinia* sp.

CAROLINE ATOLLS. EAURIPIK: June 1958, Tellei, on *Cyrtosperma* and *Crataeva* fruit. IFALUK: June 1958, Tellei, on *Crataeva* tree.

HOSTS: *Annona*, breadfruit, citrus, guava, *Cyrtosperma*, and *Terminalia* are plants of economic importance in Micronesia which have been found infested with this mealybug. Takahashi (1939) recorded this species from Woleai Atoll, on *Plumeria*.

Genus **Pseudococcus** Westwood

Pseudococcus Westwood, 1840, An Introduction to the Modern Classification of Insects . . . Synopsis of the British Insects (at end of vol. 2), p. 118 (not seen).—Ferris, 1950, Atlas Scale Ins. North America **5**: 170 (discussion of nomenclatural problems involving this genus).

Type of genus: *Coccus adonidum* L.

Ferris (1950: 172) redefined *Pseudococcus*, limiting the genus to species possessing dorsal oral-rim tubular ducts, usually 17 marginal pairs of cerarii, and certain other characteristics.

Elsewhere (Beardsley, 1962) I have pointed out the similarity in structure of the adult male penial sheath in *P. adonidum*, in certain endemic Hawaiian species, and in one new Micronesian species (*P. microadonidum*) which is described below. In other species which have females in many respects similar to those of *P. adonidum* (for example *P. orchidicola* Takahashi) the male penial sheath is of a different type. Furthermore, in *P. orchidicola* the spiral form of the sperm bundles differs from that found in males of *P. adonidum* and related species. A few females of two species for which males are unavailable (*P. solomonensis* Williams and *P. trukensis* n. sp.) were found to contain sperm bundles, and these are of the type occurring in *P. orchidicola*. This is of particular interest inasmuch as females of *P. trukensis*, in particular, more closely resemble females of *P. adonidum* than of *P. orchidicola*. It seems quite possible that the male sex will be found to hold the key to clarification of phylogenetic relationships in *Pseudococcus*, *Dysmicoccus*, and other such poorly understood genera which are now defined solely by characters of the females.

KEY TO MICRONESIAN SPECIES OF PSEUDOCOCCUS

1. All 17 pairs of cerarii borne on small sclerotized areas; venter of abdominal segment 8 with a row of 3 or 4 moderately large oral-rim tubular ducts on each side along posterior margin..... **pandanicola**
   With at most the two posterior pairs of cerarii borne on sclerotized areas; venter of abdominal segment 8 without such rows of oral-rim tubular ducts..... 2

2. Ventral multilocular disc pores present on more than two segments anterior to vulva 3
   Ventral multilocular disc pores restricted to vulvar region, confined to abdominal segment 8 and occasionally to 7 anterior to vulva 10
3. Large dorsal oral-rim tubular ducts numerous, 90 to 100 present arranged in transverse rows of 8 to 20 ducts on thoracic and abdominal segments .... **casuarinae**
   Dorsal oral-rim tubular ducts less plentiful, a maximum of 6 on any segment of thorax or abdomen 4
4. Ventral side of anal lobes more strongly sclerotized than dorsal cerarial area; 1 to 4 small discoidal pores present along posterior margin of each eye, and 2 to 4 such pores on posterior portion of each ventral anal lobe sclerotized area .... **neomaritimus**
   Ventral side of anal lobes not noticeably more strongly sclerotized than dorsal cerarial area; discoidal pores on margins of eyes and venter of anal lobes absent 5
5. Dorsal oral-rim tubular ducts relatively numerous, totaling 20 or more, 1 usually laterally near each of most abdominal and thoracic cerarii, plus a few mid-dorsally .. 6
   Dorsal oral-rim tubular ducts relatively few, totaling not more than 10, and usually 6 or less 9
6. Metacoxae with numerous micropores, totaling 30 or more discernible 7
   Metacoxae with relatively few such micropores, about 2 to 10 discernible; conical setae of cerarii, except for those of anal lobes, very small, all of about equal size and about one-half as long as those of anal lobe cerarii ..... **dybasi**
7. Appendages relatively long, rostrum about 175–180 μ in length; micropores of hind legs more numerous, hind tibiae each with around 70 or more discernible .. **comstocki**
   Appendages shorter, rostrum about 120-130 μ long; micropores of hind legs less numerous, hind tibiae each with around 15 to 25 discernible 8
8. Circulus relatively large, length greater than that of hind coxa; multilocular disc pores more numerous, around 200 total ..... **macrocirculus**
   Circulus smaller, length less than that of hind coxa; multilocular disc pores less numerous, around 80 total ..... **gilbertensis**
9. Dorsal body setae elongate, about 90 μ maximum length; ventral tubular ducts less numerous, 10 to 20 along lateral margin of each of abdominal segments 6 to 8, at most a few scattered along margins of head and prothorax; usually with a few oral-rim tubular ducts ventrally along lateral margins of thorax ..... **citriculus**
   Dorsal body setae shorter, about 50 μ maximum length; ventral tubular ducts more numerous, about 60 to 80 or more on lateral areas of each of abdominal segments 6 to 8, extending in a nearly continuous lateral band anteriorly to near eye ..... **multiductus**
10. Normally with 1 large and 2 smaller oral-rim tubular ducts dorsally near each abdominal cerarius anterior to the antipenultimate, and near most thoracic cerarii, occasionally with but 1 large and 1 small oral-rim tubular duct near some cerarii; anal lobe and penultimate cerarii both strongly sclerotized, with trilocular pores strongly concentrated (fig. 13, *e, f*); hind tibiae normally with 60 to 80 discernible micropores ..... **adonidum**
    With fewer oral-rim tubular ducts along lateral margins of dorsum, 2 or fewer such ducts associated with each cerarius, except occasionally 3 such ducts near one or two cerarii in some specimens of one species; sclerotization if present on penultimate cerarii usually noticeably weaker; trilocular pores of anal lobe cerarii less strongly concentrated; hind tibiae often with fewer micropores 11
11. Dorsal tubular ducts relatively few, not more than 8, usually of the oral-rim type, sometimes reduced to a single duct, or occasionally absent ..... **solomonensis**
    Dorsal tubular ducts more numerous, 14 or more, usually of the oral-rim type, although these at times partially replaced by oral-collar ducts 12

12. With a conspicuous group of 5 to 7 tubular ducts around each inter-antennal cerarius; ventral tubular ducts relatively numerous along lateral margins of body, 3 to 5 located near most cerarii of abdomen and thorax.....**orchidicola**
    Usually with 4 or fewer tubular ducts associated with each inter-antennal cerarius; ventral tubular ducts less numerous along lateral margins of body, 2 or less associated with almost all cerarii, rarely 3.....13
13. Ventral multilocular disc pores reduced to a very few, not more than 4 on margins of vulva, sometimes wanting; rostrum large, about 175–180 μ long.....**trukensis**
    Ventral multilocular disc pores more numerous, usually 8 or more discernible; rostrum shorter, 155 μ or less in length.....14
14. Tubular ducts usually absent along lateral margins of venter, with at most 1 or 2 discernible.....**yapensis**
    Tubular ducts more plentiful along lateral margins of venter, 1 or more associated with most abdominal and thoracic cerarii.....15
15. Penultimate cerarii borne on a strongly sclerotized area which stains about as darkly as anal lobe cerarii; rostrum short, about 120 μ long.....**microadonidum**
    Penultimate cerarii borne on an unsclerotized or very weakly sclerotized area; if weakly sclerotized then rostrum is longer, about 140–150 μ.....16
16. Larger species to 2.6 mm.; rostrum 140–150 μ long; antennae about 480 μ or more long; penultimate cerarii sometimes weakly sclerotized.....**marshallensis**
    Smaller species to 1.4 mm.; rostrum about 120 μ long; antennae about 400 μ long or less; penultimate cerarii unsclerotized.....**kusaiensis**

30. Pseudococcus adonidum (Linnaeus) (fig. 13, *e*, *f*).

Coccus adonidum Linnaeus, 1758, Syst. Nat., ed. **10**: 455.

Dactylopius longispinus Targioni-Tozzetti, 1868, Soc. Ital. Sci. Nat. Atti. **11**: (not seen).

Pseudococcus longispinus: Fernald, 1903, Cat. Coccidae of World, 104.

Pseudococcus adonidum: Zimmerman, 1948, Insects of Hawaii **5**: 180, fig. 178.—Ferris, 1950, Atlas Scale Ins. North America **5**: 174, fig. 65.—Beardsley, 1960, Hawaiian Ent. Soc., Proc. **17** (2): 201, figs. 1, 2 *a–c* (male).

DISTRIBUTION: Widespread (type locality: not specified), Hawaii, Micronesia (?).

HOSTS: Recorded from a wide variety of hosts throughout the world. Among plants which are of economic importance in Micronesia, it has been recorded elsewhere from avocado, breadfruit, citrus, coffee, mango, and pineapple.

This species, as it has been defined by recent workers, is not represented in the Micronesian survey material. Oakley (1946: 38) reported *P. adonidum* from Ton (Tol) I., Truk, but I have not seen specimens. It has been included here and in the key to Micronesian species of *Pseudococcus* as it is a common widespread form which is likely to be present in Micronesia, and to differentiate it from several very similar forms which are represented in the material from Micronesia. In Hawaiian specimens which have been taken as representative of *P. adonidum*, both the anal lobe and penultimate cerarii are strongly sclerotized, and in both the trilocular pores are plentiful and

strongly concentrated about the bases of the conical setae (fig. 13, *e*, *f*). None of the Micronesian forms studied have the trilocular pores as numerous and strongly concentrated as in *P. adonidum*, although in one form, *P. microadonidum* n. sp., the penultimate cerarii are as strongly sclerotized as in *P. adonidum*, and in several other species the penultimate cerarii are moderately sclerotized. These characteristics of the 2 posterior pairs of cerarii, plus the presence of 3 oral-rim tubular ducts of different sizes dorsally near most of the cerarii, will distinguish *P. adonidum* from any of the several forms of similar appearance which are in Micronesia. The characteristic thickening near the mesal border of the ventral sclerotized area of the anal lobes is of little value in separating *P. adonidum* from related Micronesian forms as a similar thickening is quite well developed in several of these.

31. Pseudococcus casuarinae (Takahashi), new combination.

Ferrisiana casuarinae Takahashi, 1939, Tenthredo **2** (3) : 258, fig. 9.

DISTRIBUTION: Caroline Is. Endemic ?

PALAU. KOROR: Ngarmid (Arumizu), Jan. 1938, Esaki, on *Casuarina* (two specimens on 1 slide designated as cotypes by Takahashi); Jan. 1954, Beardsley, on *Casuarina* sp.

HOST: *Casuarina*.

There appears to be no justification for Takahashi's placement of this species in *Ferrisiana* (=*Ferrisia*). Except for the relatively abundant dorsal oral-rim tubular ducts, it seems to be a fairly typical *Pseudococcus* of the general type of *P. comstocki*, with 17 distinct pairs of cerarii, multilocular disc pores confined to venter, and so on. The type of *Ferrisia* (*F. virgata*) and other species placed there by Ferris have in common the possession of a single pair of cerarii (the anal lobe pair), and oral-collar ducts with mouths surrounded by small sclerotized areas bearing one or more setae. Such ducts are not present in *P. casuarinae*.

32. Pseudococcus citriculus Green.

Pseudococcus citriculus Green, 1922, Coccidae of Ceylon **5** : 377, pl. 154.—Zimmerman, 1948, Insects of Hawaii **5** : 210, fig. 117½.—Beardsley, 1960, Hawaiian Ent. Soc., Proc. **16** (2) : 226, fig. 3, *c* (male).

DISTRIBUTION: Ceylon (type locality), Hawaii, Caroline Is.

PALAU. KOROR: Sept. 1953, Beardsley, on *Citrus*.

PONAPE. Colonia, Administration Bldg., Aug. 1946, Oakley, on orange; Experiment Station (near Colonia), Aug. 1946, Oakley, on orange leaves; in quarantine at Honolulu, Ross, on *Citrus paradisi*.

HOSTS: Various kinds of citrus.

Pseudococcus citriculus has been redescribed and figured by Ferris (*In* Zimmerman, 1948 : 210, fig. 117½). Structurally it resembles *P. comstocki*, *P. dybasi*, and *P. macrocirculus*, but has relatively few dorsal oral-rim tubular ducts, and the dorsal body setae are conspicuously more elongate than in any of the above. It can be separated from *P. multiductus*, described below, by the relatively few oral-collar tubular ducts along the lateral margins of the venter and the longer dorsal body setae.

33. Pseudococcus comstocki (Kuwana).

Dactylopius comstocki Kuwana, 1902, Calif. Acad. Sci., Proc. **3** (3) : 52.
Pseudococcus comstocki: Fernald, 1903, Cat. Coccidae of World, 100.—Ferris, 1950, Atlas Scale Ins. North America **5** : 177, fig. 66.—Wilkey and McKenzie, 1961, Dept. Agric. State Calif., Bull. **50** (4) : 248, fig. 3.—Beardsley, 1962, Hawaiian Ent. Soc., Proc. **18** (1) : 92, fig. 3, *i* (male).

DISTRIBUTION: Japan (type locality), Continental U.S., Micronesia (?).

HOSTS: Reported by Takahashi on *Pandanus* in Micronesia, this species has been recorded elsewhere from a wide range of hosts.

Comstock's mealybug has been reported by Takahashi (1941 : 214) from Ponape and Saipan, on *Pandanus*. This species is not represented in the material which I have examined, although several apparently related species are present in Micronesia. It is possible that the Micronesian records of *P. comstocki* are misidentifications. Specimens from Japan and the United States were examined during this study, and the species has been included in the key to Micronesian *Pseudococcus* on the basis of these specimens. Ferris (1950 :177, fig. 66) has redescribed and figured *P. comstocki*, and more recently Wilkey and McKenzie (1961 : 248) have discussed this species and have figured the hind legs to show the distribution of the micropores.

34. Pseudococcus dybasi Beardsley, n. sp. (fig. 9).

Female. Size moderately large, length of slide-mounted specimens about 2.1–2.6 mm.; body form elongate-oval; anal lobes moderately protuberant. Antennae 8-segmented, around 340–360 μ long, incompletely 8-segmented or 7-segmented in a few specimens. Legs moderately small; hind femora about 170 μ long; hind tibiae about 170 μ long. Hind legs with relatively few micropores, around 2 to 10 discernible in each hind coxa; 5 to 15 on each hind femur; and 5 to 12 on each hind tibia; absent on hind trochanters and tarsi. Rostrum moderately short, about 135 μ in length. Anal ring cellular, about 75 μ wide, bearing 6 setae about 105–110 μ maximum length. Two pairs of dorsal ostioles present, their lips unsclerotized. Circulus present, moderately small, about 60 μ long by 80–85 μ wide, extending across intersegmental membrane between abdominal segments 4 and 5. Eyes of moderate size, about 30 μ diameter, without appreciable development of ocular cone; paraocular discoidal pores wanting.

With 17 pairs of marginal cerarii. Anal lobe cerarii each with 2 conical setae about 18 μ long, 3 or 4 slender accessory setae about 27 μ maximum length, plus a concentration of around 25 to 30 trilocular pores, borne on an area of light to moderate sclerotization. Penultimate cerarii and anterior abdominal cerarii each with 2 small conical setae about

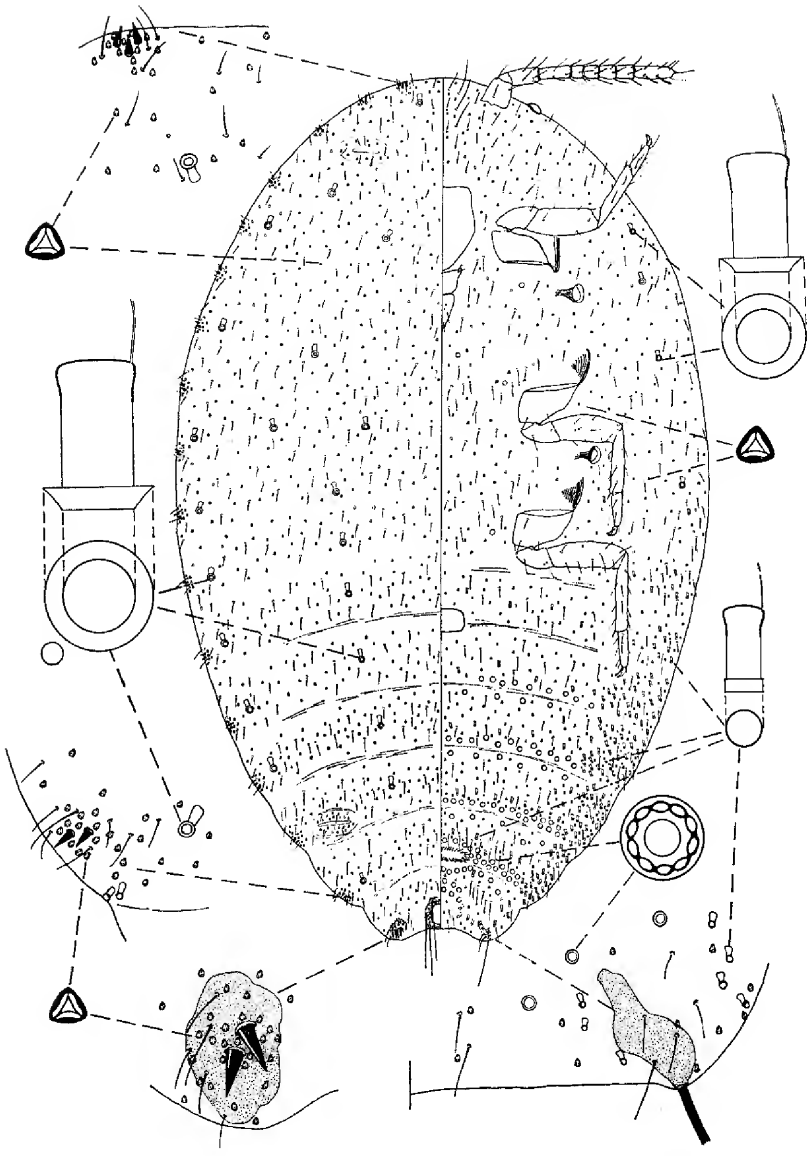

FIGURE 9.—*Pseudococcus dybasi*, adult female, dorsal and ventral aspects and details.

8–11 μ long, 3 to 5 slender accessory setae about 19 μ maximum length, plus a slight concentration of around 9 to 14 trilocular pores; the surrounding derm unsclerotized. Anterior thoracic and cephalic cerarii each with 2, 3, or occasionally 4 such small conical setae, otherwise similar. Venter of anal lobe with a small elongate area of weak sclerotization. Anal lobe seta rather short, about 85–90 μ maximum length.

Oral-rim tubular ducts, 9–10 μ diameter across rim, fairly numerous on dorsum; arranged in a marginal series of 1 near each of most abdominal cerarii, except those of segments 7 and 9, 1 just behind each interantennal cerarius on head, and 1 near each of several thoracic cerarii, there being 8 to 10 such ducts on each side; 2 to 4 such ducts in a transverse row on the central part of the dorsum on each abdominal segment anterior to segment 8 and on thoracic segments. Oral-rim ducts frequently with 1 or 2 very small (1.5–2 μ diameter) simple circular pores near rim. Venter with a few (2 to 5) oral-rim ducts along lateral margin of thorax on each side, plus numerous small oral-collar tubular ducts, 2–3 μ diameter at orifice, in a band along lateral margins of abdominal segments 3 to 8; a few such ducts on margins of segments 2 and 9; and in a transverse row across posterior part of abdominal segments 4 to 8. A few (usually 4 to 6) oral-rim ducts along lateral margin of venter of thorax on each side. Multilocular disc pores confined to venter, totaling around 150 to 160, a row along the posterior margin of abdominal segment 5, and rows on anterior and posterior margins of segments 6 to 8, plus a few behind vulva on segments 9 and 10. A very few multilocular pores scattered on venter of thorax and anterior abdominal segments. Trilocular pores moderately sparsely scattered on dorsum and venter. Body moderately sparsely clothed with short fine setae; those of dorsum mostly 16–24 μ long; those of venter mostly 10–21 μ long; setae around vulva up to about 30 μ long; longer setae on venter of head anterior to mouthparts up to about 52 μ long.

Holotype, female (US 67969) and 2 paratypes on 1 slide, Ulebsehel (Aurapushekaru), Palau Is., Jan. 1948, Dybas, under bark flakes on live tree tended by ants; 18 paratypes (BISHOP, UH, US) on 6 slides, same data.

DISTRIBUTION: Caroline Is. (Palau).

HOSTS: Under bark of unknown tree.

P. dybasi appears allied to *P. comstocki* and to *P. macrocirculus* n. sp. It differs from both species in possessing considerably fewer metacoxal micropores and in having the conical setae of the cerarii, anterior to those of the anal lobes, all relatively small (8–11 μ long vs. about 15 μ long in penultimate cerarii of *macrocirculus* and about 20 μ in available specimens of *comstocki*). The relatively much larger circulus of *macrocirculus* will also serve to distinguish it from *P. dybasi*.

35. Pseudococcus gilbertensis Beardsley, n. sp. (fig. 10).

Female. Size moderate, length of slide-mounted specimens 2.0 to 2.5 mm.; body form elongate-oval; anal lobes moderately protuberant. Antennae 8-segmented, about 450 μ long. Legs moderately slender; hind femora each about 250 μ long, hind tibiae about 250 μ long. Hind coxae each with around 30 to 50 translucent spots or micropores, mostly on upper (posterior) face, distributed as indicated in figure; hind femora each with about 15 to 20 such micropores on upper face; hind tibiae each around 20 to 25 such micropores. Rostrum about 125 μ long. Two pairs of dorsal ostioles present. Circulus present, moderately large, 105 μ wide by about 75 μ long, extending across intersegmental fold between abdominal segments 4 and 5. Eyes of moderate size, about 30 μ diameter with a moderately well-developed ocular cone; paraocular discoidal pores absent. Anal ring cellular, about 85 μ wide, bearing 6 setae about 160 μ maximum length.

With 17 pairs of marginal cerarii. Anal lobe cerarii each with 2 conical setae about 28–29 μ long, 6 to 8 slender accessory setae about 55 μ maximum length, plus a cluster of around 35 to 45 trilocular pores, borne on a well-defined sclerotized area. Penultimate

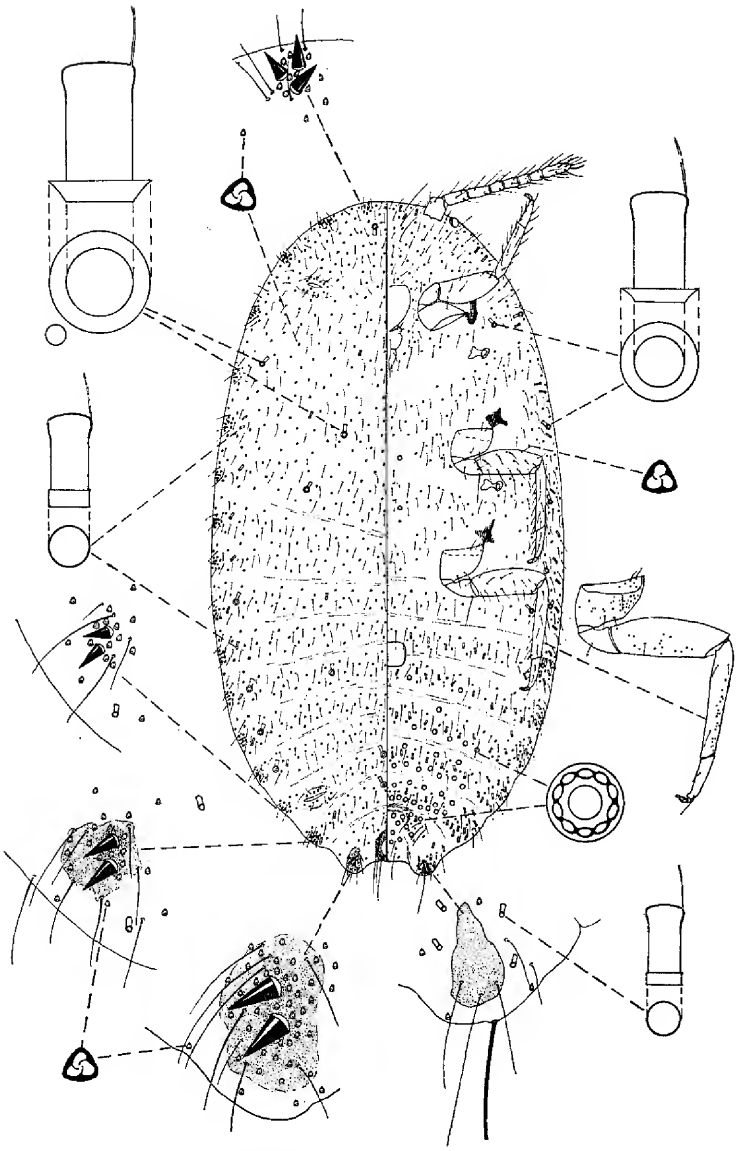

FIGURE 10.—*Pseudococcus gilbertensis*, dorsal and ventral aspects and details.

cerarii each with 2 conical setae about 18 μ maximum length plus 5 or 6 slender accessory setae about 35 μ maximum length and a small group of around 12 to 18 trilocular pores, borne on a small area of weak sclerotization. Anterior abdominal cerarii each with 2 conical setae, many of those on thorax and head with 3 or 4 conical setae, around 16 μ maximum length, accompanied by 2 to 5 slender accessory setae and a small concentration of around 10 to 12 trilocular pores; the surrounding derm unsclerotized. Venter of anal lobes each with a small, well-defined sclerotized patch. Anal lobe seta about 120 μ long.

Dorsum with around 18 to 25 oral-rim ducts, each about 10–11 μ diameter across rim, distributed in a lateral series of one near each of several abdominal and thoracic cerarii and one just behind each interantennal cerarius, plus one or two mid-dorsally on each of several thoracic and abdominal segments. Oral-rim ducts replaced by oral-collar tubular ducts about 4–5 μ diameter laterally near some cerarii; sometimes with one oral-rim and one oral-collar, or two oral-collar ducts near a few cerarii. A few oral-collar ducts usually present mid-dorsally on thorax and abdomen. One to 5 oral-rim tubular ducts about 9 μ diameter present on lateral margins of venter near each of several anterior abdominal and thoracic cerarii. Venter with moderately numerous oral-collar tubular ducts, 3–4 μ diameter, distributed along lateral margins of abdominal segments and in transverse rows across abdominal segments 4 to 9; a few such ducts scattered along lateral margins of venter of thorax and head. Multilocular disc pores confined to venter, a total of around 80 on abdominal segments behind circulus; a few discernible on venter of thorax in some specimens. Trilocular pores moderately sparsely scattered on dorsum and venter. Body moderately sparsely clothed with fine setae; those of dorsum mostly 12–40 μ in length; those of venter mostly 25–60 μ long; longer setae of venter of head, anterior to mouthparts, up to 160 μ in length.

Holotype, female (BM) and 2 paratypes on one slide, Gilbert Islands, Tarawa Atoll, Aug. 15, 1956, E. S. Brown, on *Calophyllum*; 20 paratypes (BISHOP, BM, US) on 10 slides, same data as type.

Pseudococcus gilbertensis belongs with the *P. comstocki* group of mealybug species represented in Micronesia by *P. dybasi*, *P. macrocirculus*, *P. citriculus*, and *P. multiductus*. It more closely resembles *P. comstocki* than any of the other species mentioned here. Direct comparison with Japanese and North American specimens, determined as *P. comstocki* by Dr. Harold Morrison, revealed the following differences: In *P. gilbertensis* the appendages are smaller, the rostrum, for example, measuring 125 μ long in *gilbertensis* vs. 175–180 μ in *P. comstocki*. The hind legs of *gilbertensis* have noticeably fewer of the small translucent spots or micropores than do those of *comstocki*, and the latter also possesses many more dorsal oral-rim tubular ducts and ventral multilocular pores than does *P. gilbertensis*.

The type material of this species was made available for study through the kindness of Dr. D. J. Williams, Commonwealth Institute of Entomology, London.

36. Pseudococcus kusaiensis Beardsley, n. sp. (fig. 11).

Female. Moderately small, length of slide-mounted specimens about 1.4 mm.; body form elongate-oval; anal lobes moderately protuberant. Antennae 8-segmented, about 390 μ long; legs moderately slender, hind femora about 200 μ long, hind tibiae about 215 μ long. Hind coxae without discernible micropores; hind femora with 20 to 55 micropores; hind tibiae with 20 to 45 micropores in available specimens. Rostrum relatively short, about 120 μ in length. Two pairs of dorsal ostioles, their lips unsclerotized. Circulus moderately small, extending across intersegmental fold between abdominal segments 4 and 5.

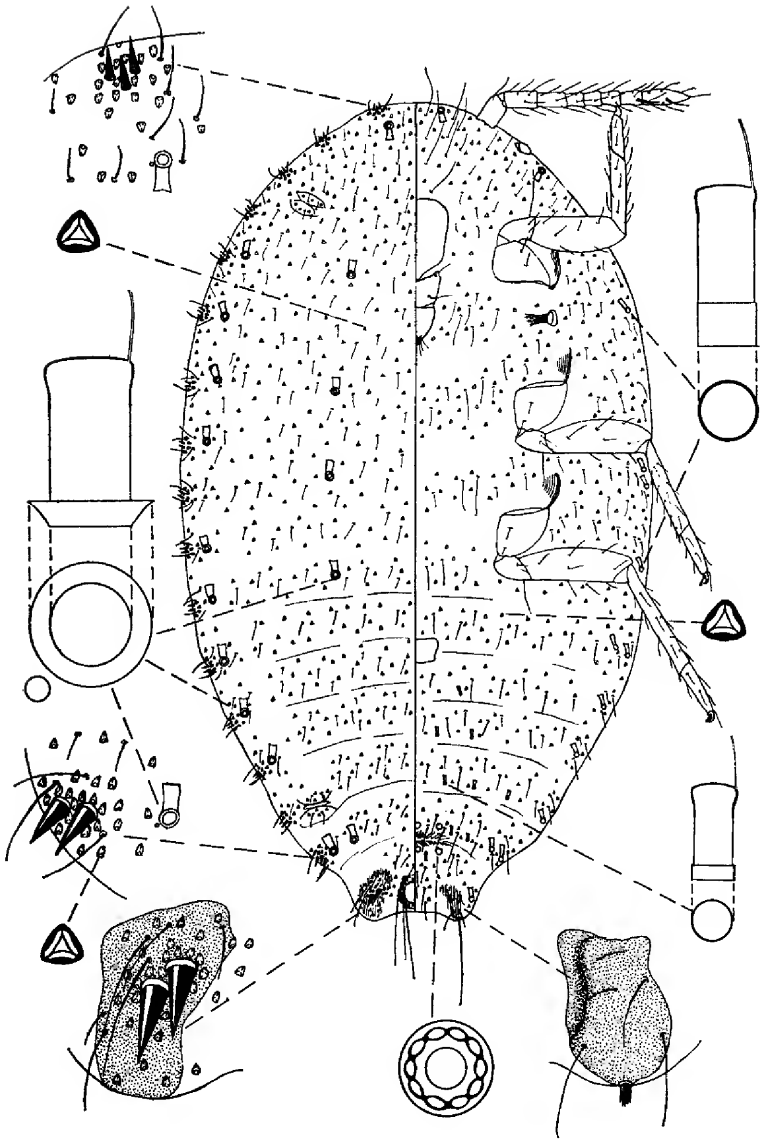

FIGURE 11.—*Pseudococcus kusaiensis*, adult female, dorsal and ventral aspects and details.

Eyes of moderate size, about 28 μ diameter, with a small ocular cone; paraocular discoidal pores absent.

With 17 pairs of marginal cerarii. Anal lobe cerarii each with 2 moderately large conical setae about 28 μ long, 5 or 6 slender accessory setae about 45 μ maximum length, and a small cluster of around 25–30 trilocular pores, borne on a well-defined sclerotized area. Penultimate cerarii each with 2 conical setae about 18 μ maximum length, plus 3 or 4 slender accessory setae and a cluster of around 20 trilocular pores. Anterior cerarii mostly with 2 conical setae 8–10 μ long, some on head and thorax with 3 such conical setae; plus 2 or 3 slender accessory setae about 25 μ maximum length and a slight concentration of around 10 to 15 trilocular pores. Venter of anal lobe with a well defined sclerotized area appearing slightly more heavily sclerotized in a narrow band near its mesal border. Anal lobe seta about 135 μ long.

Dorsum with fairly numerous oral-rim tubular ducts, about 8–9 μ diameter across rim; 1 or 2 laterally near each penultimate cerarius; 1 near each of most of the thoracic and abdominal cerarii anterior to the antipenultimate; 1 behind each interantennal cerarius on head; 6 to 8 or so on central part of dorsum on thoracic and anterior abdominal segments. Venter with a few small oral-collar tubular ducts, about 3 μ diameter at orifice, on posterior abdominal segments, around vulva, and along posterior margins of segments 5 to 7. A few larger oral-collar or oral-rim ducts present on lateral margins of venter, 1 or 2 associated with most of the abdominal and posterior thoracic cerarii, plus an occasional duct on ventral margin of head and anterior part of thorax. Multilocular disc pores very few, 6 to 8 present on margins of vulva. Trilocular pores evenly scattered on dorsum and venter. Body moderately sparsely clothed with short fine setae, those of dorsum about 30 μ maximum length, those of venter mostly 45 μ or less in length; longer setae of venter of head anterior to mouthparts about 100 μ maximum length.

Holotype, female (US 67970) and 2 paratypes on one slide, Kusaie, Aug. 1946, Oakley, on *Boehmeria*; 11 paratypes (BISHOP, US) on 4 slides, same data as holotype.

DISTRIBUTION: Caroline Is. (Kusaie).

HOST: *Boehmeria* sp.

This is a relatively small species somewhat similar to *P. microadonidum* n. sp., from which it may be distinguished by the absence of sclerotized areas around the penultimate cerarii, and by having all the dorsal oral-rim tubular ducts of one size, whereas there are two distinct sizes of these ducts in *P. microadonidum*. *P. kusaiensis* may be distinguished from *P. yapensis* n. sp. by the absence of tubular ducts along the ventral margins in the latter, and from the remaining Micronesian species of the general type of *P. adonidum* by its small size, short beak, and other characters.

37. Pseudococcus macrocirculus Beardsley, n. sp. (fig. 12).

Female. Moderately large, length of slide-mounted specimens 2.0–2.4 mm.; body form elongate-oval; anal lobes slightly protuberant. Antennae 8-segmented, about 480 μ long. Legs of moderate size; hind femora about 245 μ long; hind tibiae about 240 μ long. Micropores present in hind coxae, femora, and tibiae; absent in trochanters and tarsi; about 30 to 40 discernible in hind coxae, 25 to 35 in hind femora, and 15 to 20 on hind tibiae. Rostrum moderately short, about 120–125 μ long. Anal ring cellular, bearing 6 setae about 150 μ maximum length. Two pairs dorsal ostioles present, their lips not noticeably sclerotized. Circulus present, relatively very large, length when undistorted up to about 185 μ, extending across intersegmental fold between abdominal segments 4 and 5. Eyes of moderate size, about 30 μ diameter, ocular cone weakly developed; paraocular discoidal pores absent.

With 17 pairs of marginal cerarii. Anal lobe cerarii each with 2 conical setae about 24 μ long, 3 to 5 slender accessory setae about 45 μ maximum length, plus a concentration

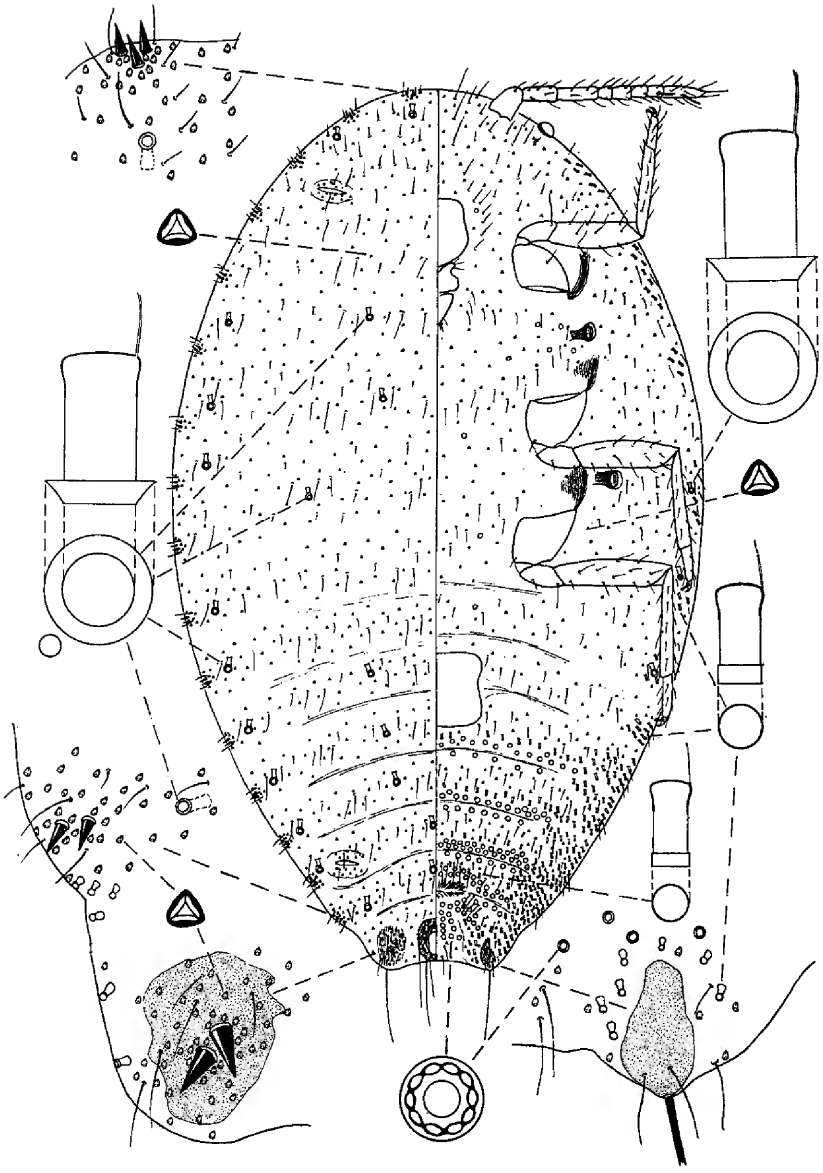

FIGURE 12.—*Pseudococcus macrocirculus*, adult female, dorsal and ventral aspects and details.

of around 50 trilocular pores, on a moderately well defined sclerotized area. Penultimate cerarii each with 2 conical setae 12–16 μ long, 2 or 3 slender accessory setae about 30 μ maximum length, plus a concentration of about 12 to 16 trilocular pores; the surrounding derm unsclerotized. Anterior cerarii mostly with 2 conical setae, about 15 μ long, those of head and anterior part of thorax occasionally with 3 such setae, each with 2 or 3 slender accessory setae about 30 μ maximum length, plus a concentration of a few (usually 10 to 15) trilocular pores. Venter of anal lobe with a small, elongate sclerotized area. Anal lobe seta about 160 μ long.

Oral-rim tubular ducts, about 9–10 μ diameter across rim, fairly plentiful on dorsum; 1 laterally near each cerarius on abdominal segments 2 to 8; 1 just behind each interantennal cerarius; and 1 near each of several of the remaining cephalic and thoracic cerarii; 1 or 2 on the central part of dorsum of each of several abdominal and thoracic segments; total on dorsum about 34 to 40. A few (1 to 3) small circular disc pores present near margins of many dorsal oral-rim ducts. Venter with numerous small oral-collar tubular ducts 3–4 μ diameter at orifice, in a band along lateral margins of abdominal segments 4 to 9, and less abundantly scattered along margins of posterior abdominal and thoracic segments and onto lateral margin of head behind eye. A submedian transverse row of oral-collar ducts extending across venter of abdominal segments 5 to 8. A few oral-rim ducts, usually 2 to 5 on each side, on lateral margins of anterior abdominal and thoracic segments. Multilocular disc pores confined to venter; fairly numerous on abdominal segments 5 to 10 behind circulus, a row on posterior margin of segment 5, and rows along both anterior and posterior margins of segments 6 to 9. A very few scattered multilocular pores on anterior abdominal and thoracic segments, particularly near anterior spiracles; sometimes 1 or 2 discernible on venter of head. Trilocular pores sparsely scattered on dorsum and venter. Body sparsely clothed with fine setae; those of the dorsum up to about 30 μ maximum length; those of venter about 60 or 70 μ maximum length; longer setae on venter of head anterior to mouthparts about 95 μ maximum length.

Holotype, female (BISHOP 6140) and 2 paratypes on 1 slide, Ngerkabesang I., Palau Is., Feb. 1954, Beardsley, on *Barringtonia*; 5 paratypes (US, UH), on 2 slides, same data.

Palau Is., Babelthuap, Ulimang, Dec. 1947, Dybas, beating vegetation in lowland forest; Ngerkabesang, Feb. 1954, Beardsley, on *Barringtonia*; Ulebsehel (Aurapushekaru), Jan. 1948, Dybas, beating vegetation. Yap I., Yap, Ruul District, Aug. 1950, Goss, on *Sonneratia caseolaris*. Eauripik, Caroline Atolls, June 1958, Tellei, on *Cyrtosperma* leaves; Jan. 1964, Owen, on *Cyrtosperma*.

DISTRIBUTION: W. Caroline Is. (Palau, Yap, Eauripik).

HOSTS: *Cyrtosperma*, and several uncultivated plants.

This species resembles *P. comstocki* (Kuwana), from which it may be distinguished by its relatively large circulus, and the markedly fewer micropores in the hind legs. In addition, the beak is relatively short (about 120–125 μ) compared to that of *P. comstocki* (170–180 μ long in examples at hand).

38. Pseudococcus marshallensis Beardsley, n. sp. (fig. 13, *a–d*).

Female. Size moderate, length of slide-mounted specimens about 2.2 to 2.6 mm.; body elongate-oval; anal lobes moderately protuberant. Antennae 8-segmented, about 480 μ long. Legs moderately large; hind femora about 270 μ long; hind tibiae around 250–270 μ long. Hind coxae without micropores; hind femora with 20 to 30 micropores discernible; hind tibiae usually with 15 to 25 such pores. Rostrum 140–150 μ long. Anal ring cellular, about

85 μ wide, with 6 setae about 155 μ maximum length. Two pairs dorsal ostioles present, their lips unsclerotized. Circulus moderately large, extending across intersegmental fold between abdominal segments 4 and 5. Eyes moderately large, about 36 μ in diameter, with a moderately large ocular cone; paraocular discoidal pores absent.

With 17 pairs of marginal cerarii. Anal lobe cerarii (fig. 13, *d*) each with 2 large conical setae about 30 μ long, plus 4 or 5 slender accessory setae about 60 μ maximum length surrounded by a moderately dense concentration of around 50 trilocular pores, and borne on a well-defined sclerotized area. Penultimate cerarii (fig. 13, *c*) each with 2 conical setae about 18 μ long, plus 4 or 5 slender accessory setae and a concentration of around 30 trilocular pores, borne on an area of weak sclerotization. Anterior cerarii mostly with 2 conical

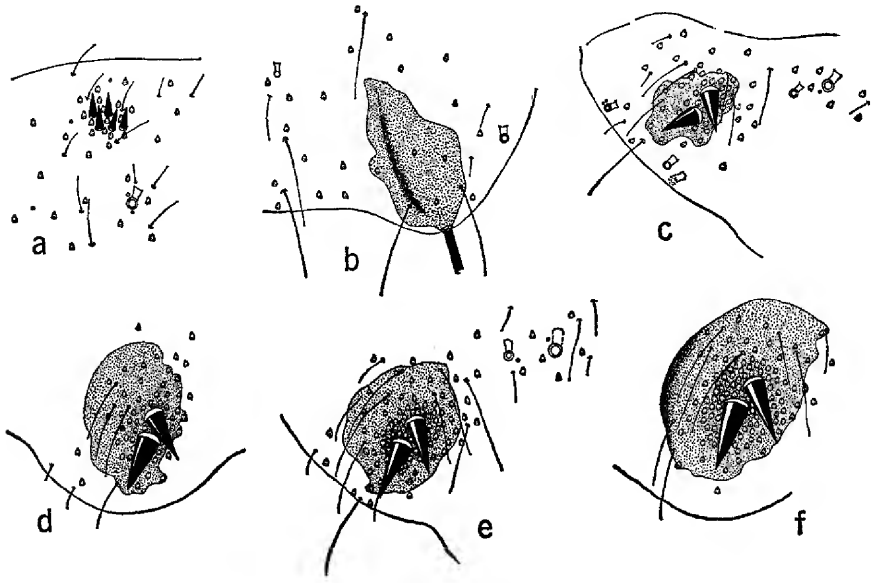

FIGURE 13.—**a–d**, *Pseudococcus marshallensis*: *a*, interantennal cerarius; *b*, venter of anal lobe; *c*, penultimate cerarius; *d*, anal lobe cerarius. **e**, **f**, *P. adonidum*: *e*, penultimate cerarius; *f*, anal lobe cerarius.

setae, except those of head and anterior part of thorax frequently with 3 to 6 such setae (fig. 13, *a*), mostly 15 μ or less in length, plus 1 to 3 slender accessory setae, and a concentration of about 10 to 20 trilocular pores, surrounding derm unsclerotized. Venter of anal lobe (fig. 13, *b*) with a well-developed elongate sclerotized area with a somewhat more heavily sclerotized strip near its mesal border. Anal lobe setae around 110–130 μ long.

Dorsal oral-rim tubular ducts fairly numerous, of two sizes, the larger 9–10 μ diameter across rim, the smaller 6–7 μ diameter across rim; usually 1 large and 1 small oral-rim duct laterally near most cerarii except those of anal lobes, the antipenultimate, and 2 or 3 pairs of head and thorax; an occasional cerarius with 1 large and 2 small oral-rim ducts, or a single large, or a single small such duct. A few larger type oral-rim ducts present on central portion of dorsum of 1 or more thoracic and anterior abdominal segments. Usually with 1 oral-rim duct, either large or small, on lateral margin of venter near each cerarius; occasionally 2 or 3 such ducts, particularly near penultimate and antipenultimate cerarii, these sometimes lacking well-developed oral rims. A few small oral-collar tubular ducts in transverse rows across venter of abdominal segments behind circulus, about 3–4 μ diameter

at orifice. Multilocular disc pores limited to a few around margin of vulva, 8 to 14 in available specimens. Trilocular pores evenly and fairly densely scattered on dorsum and venter. Body clothed with short, fine setae; those of dorsum about 27 μ maximum length, those of venter longer, about 50 μ maximum length.

Holotype, female (US 67971), Imroj (Imrodj) I., Jaluit Atoll, Marshall Is., Aug. 24, 1946, Oakley, on *Artocarpus altilis*; 9 paratypes on 3 slides (BISHOP, UH), same data. Additional specimens: Ailinglapalap I., Ailinglapalap Atoll, Marshall Is., Aug. 1946, Oakley, on *A. altilis*; Majurirok I., Jaluit Atoll, Sept. 1953, Beardsley, on breadfruit; Imroj (Imrodj) I., Jaluit, Aug. 1946, Oakley, on *Pipturus*. Lele, Kusaie, Caroline Is., Aug. 1946, Oakley, on breadfruit.

DISTRIBUTION: Marshall Is. (Ailinglapalap, Jaluit), Caroline Is. (Kusaie).

HOSTS: Breadfruit (*Artocarpus altilis*), *Pipturus*.

Pseudococcus marshallensis resembles *P. adonidum* in general appearance, but can be differentiated by the characters stressed in the key to Micronesian species of *Pseudococcus*, such as penultimate cerarii less strongly sclerotized; with less numerous and less concentrated groups of trilocular pores around conical setae of anal lobe and penultimate cerarii; and with fewer oral-rim tubular ducts dorsally, there being usually 2, only occasionally 3, near most cerarii in *marshallensis*, whereas *adonidum* usually has 3, only occasionally 2. Also, *P. marshallensis* appears to have somewhat fewer micropores in the hind femora and tibiae than does *adonidum*, there being around 20 to 30 in the femora (30 to 40 in *adonidum* specimens examined), and about 15 to 25 in the hind tibiae (40 to 60 in *adonidum*). *P. marshallensis* is also similar to *P. trukensis*, described below, but may be separated from the latter by its relatively short appendages (rostrum 140–150 μ long in *marshallensis*, 170–185 μ long in *trukensis*), more numerous dorsal oral-rim tubular ducts laterally near cerarii, and more numerous multilocular disc pores around vulva (8 to 14 in *marshallensis*, 0 to 4 in *trukensis*).

39. Pseudococcus microadonidum Beardsley, n. sp. (figs. 14; 21, *c*).

Female. Size moderately small, length of slide-mounted specimens about 2 mm. or a little over; body form elongate-oval; anal lobes only slightly protuberant. Antennae normally 8-segmented, occasionally 7- or incompletely 8-segmented; about 400–420 μ long. Legs of moderate size; hind femora about 230 μ long; hind tibiae about 220 μ long. Hind coxae without micropores; hind femora with 8 to 15 micropores usually discernible; hind tibiae with 12 to 18 such pores usually present (fig. 21, *c*). Rostrum rather short, about 120 μ in length. Anal ring cellular, about 75 μ wide, with 6 setae about 150 μ maximum length.

Two pairs of dorsal ostioles, small, their lips unsclerotized; circulus moderately large, extending across intersegmental line between abdominal segments 4 and 5. Eyes 28–30 μ in diameter; ocular cone small; paraocular discoidal pores absent.

Seventeen pairs of marginal cerarii present. Anal lobe cerarii each with 2 conical setae about 22–25 μ long, plus 5 or 6 slender accessory setae about 40 μ maximum length, surrounded by a moderate concentration of around 35 to 40 trilocular pores, and borne on a small sclerotized area. Penultimate cerarii each with 2 somewhat smaller conical setae about 15–18 μ long, plus 3 to 5 slender accessory setae, and a slight concentration of around

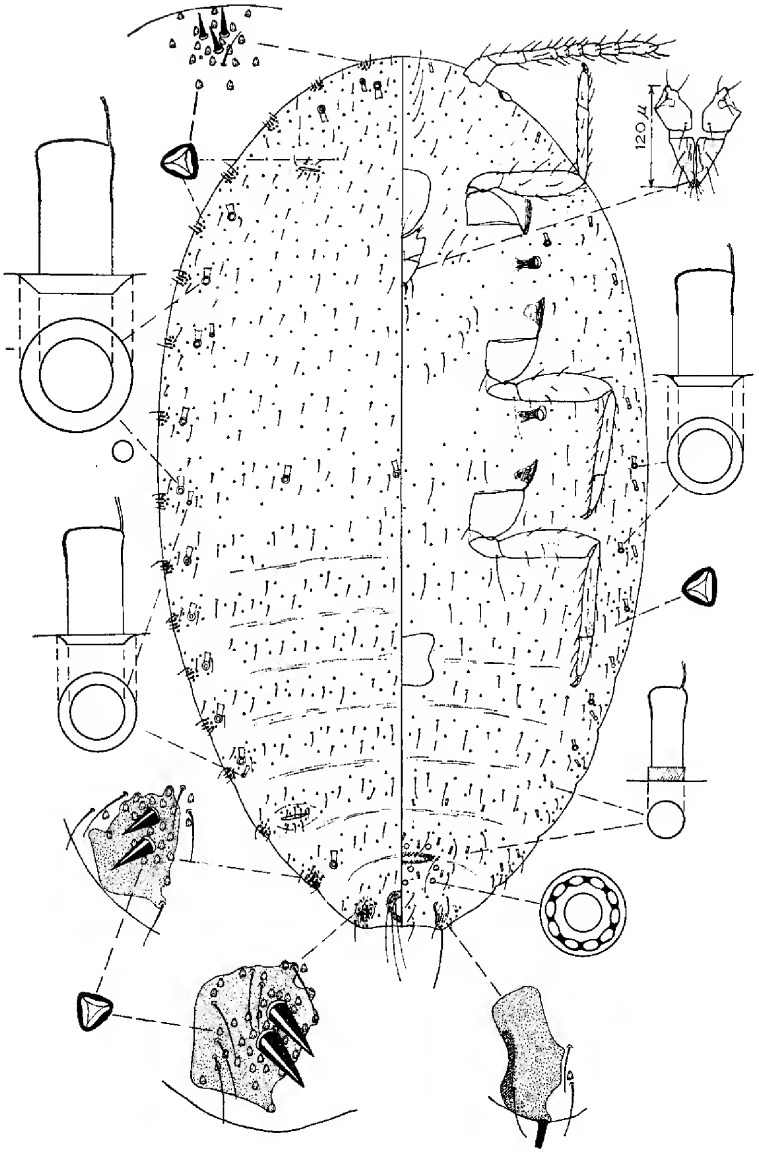

FIGURE 14.—*Pseudococcus microadonidum*, adult female, dorsal and ventral aspects and details.

20 trilocular pores, borne on a small but definite sclerotized area. Anterior cerarii with 2 small conical setae, occasionally 3 or 4 in those on anterior part of thorax and head, mostly 9 or 10 μ long, plus 1 or 2 slender accessory setae, and a small concentration of around 6 to 12 trilocular pores; surrounding derm unsclerotized. Venter of anal lobes with a definite elongate sclerotized area with a conspicuously more strongly sclerotized section along its mesal border. Anal lobe seta slightly shorter than anal ring setae, about 120 μ long.

Oral-rim tubular ducts of two sizes on dorsum, the larger ducts about 10–12 μ diameter across rim, the smaller about 6–7 μ diameter across rim. One large oral-rim duct laterally near most cerarii except those of anal lobes, antipenultimate segment, and 1 or 2 cerarii on anterior part of thorax and head; several cerarii, usually 3 to 6 pairs, with a small oral-rim duct present nearby. Several large oral-rim ducts usually present on central portion of anterior abdominal and/or thoracic segments. Tubular ducts present along lateral margins of venter near cerarii, 1 to 3 associated with most cerarii; these of oral-collar or oral-rim types, the latter usually smaller than the large dorsal oral-rim ducts. A few small oral-collar ducts on posterior abdominal segments of venter in vicinity of vulva, and along posterior margin of abdominal segment 7, about 3 μ diameter at orifice. Multilocular disc pores limited to a few around vulva, 6 to 14 or so in available specimens. Trilocular pores evenly, moderately sparsely scattered on dorsum and venter. Body sparsely clothed with short fine setae; those of dorsum about 25 μ maximum length; those of venter somewhat longer, about 60 μ maximum length. Long setae on venter of head anterior to mouthparts about 100 μ long.

Male. The single adult male specimen available (Colonia, Ponape, Nov. 1953, Beardsley, on coconut) is not in perfect condition and will not be designated an allotype. The important features of this specimen are: very similar to male of *P. adonidum*; antennae slightly shorter than in *adonidum*, about 550 μ long (about 700 μ in *adonidum*); segment 3 about 80 μ long (about 100 μ in *adonidum*); penial sheath very similar to *adonidum*, about 150 μ long, with well-developed median lobes; apex truncate, about 19 μ wide at tip. Other discernible features not appreciably different from *adonidum* male. Sperm bundles similar to those of *adonidum*, helical portion with a lead of about 1.5 μ.

Holotype, female (BISHOP 6141), and 2 paratypes (BISHOP) on 1 slide, Marakei Atoll, Gilbert Is., Dec. 1957, Krauss, on coconut. Three paratypes on 1 slide (US), same data as holotype. Additional specimens: Marshall Is., Engebi I., Eniwetok Atoll, May 1946, Townes, on *Cocos nucifera*; Wotho I., Wotho Atoll, Oct. 1953, Beardsley, on coconut foliage; Kwajalein Atoll, Aug. 1946, Oakley, on *Cocos nucifera*, Nov. 1958, Krauss, on coconut; Ailinglapalap I., Ailinglapalap Atoll, Aug. 1946, Oakley, on *Cocos nucifera*; Majurirok (Elizabeth) I., Jaluit Atoll, Sept. 1953, Beardsley, on banana; Likiep I., Likiep Atoll, Aug. 1946, Oakley, on *Cocos nucifera*; Telap (Dalap) I., Majuro Atoll, Aug. 1946, Oakley, on *Cocos nucifera*; Arno Atoll, July 1950, La Rivers, on banana plant. Marakei, Gilbert Is., Dec. 1957, Krauss, on coconut leaves (type material). Nukuoro I., Caroline Atolls, Aug. 1946, Oakley, on *Cocos nucifera*; Utot (Udot), Truk, May 1946, Oakley, on *Cocos nucifera*. Temwetemwensekir (Tamatamansakir), Ponape, July 1950, Adams; Nanipil-Nanpohnmal, 65 m., Jan. 1953, Gressitt, on *Pandanus*; Colonia, Nov. 1953, Beardsley, on coconut foliage.

DISTRIBUTION: Marshall Is. (Eniwetok, Wotho, Kwajalein, Ailinglapalap, Jaluit, Likiep, Majuro, Arno), Gilbert Is. (Marakei), Caroline Is. (Nukuoro, Truk, Ponape).

HOSTS: Banana, coconut, and *Pandanus*.

Although closely allied to *P. adonidum*, this species is clearly distinct. It may be separated readily from other species of the *P. adonidum* group by the smaller size of body and appendages. The length of the rostrum has been used in the key to species as this structure appears to be subject to less variation between individuals than the legs and antennae, and provides a convenient gauge to relative appendage sizes. The anal ring, conical setae of the posterior cerarii, the ventral sclerotized areas of the anal lobes and those surrounding the anal lobe and penultimate cerarii, are all correspondingly smaller in this species than in *adonidum* and other similar forms, except possibly *P. kusaiensis*. In the latter species, however, the penultimate cerarii are completely unsclerotized.

The great similarity of the male of *P. microadonidum* to that of *P. adonidum* suggests that these two species are more closely related than to some of the other Micronesian forms which are similar to *P. adonidum*. The form of the penial sheath of the male of *P. orchidicola*, the only other of this group for which males are available, is quite different, as is the form of the helical portion of the sperm bundles. The finding of sperm bundles similar to those of *orchidicola* in several of the other Micronesian forms in which the females resemble those of *P. adonidum* (such as *P. marshallensis* and *P. trukensis* n. sp.), leads to the speculation that such forms may be less closely allied to *P. adonidum* than the females suggest.

40. Pseudococcus multiductus Beardsley, n. sp. (fig. 15).

Female. Of moderate size, slide-mounted specimen about 1.9 mm. long; body moderately elongate-oval; anal lobes slightly protuberant. Antennae 8-segmented, about 390 μ long. Legs of moderate size; hind femora about 255 μ long; hind tibiae about 240 μ long. A few micropores on hind legs; hind coxae each with about 12 discernible, hind femora with about the same number, hind tibiae with around 18; micropores absent on trochanters and tarsi. Rostrum about 170 μ long. Anal ring cellular, about 120 μ wide; bearing 6 setae about 155 μ maximum length. Two pairs dorsal ostioles present, their lips unsclerotized. Circulus moderately large, extending across fold between abdominal segments 4 and 5. Eyes moderately large, about 36 μ diameter; with a small ocular cone; paraocular discoidal pores absent.

With 17 pairs of marginal cerarii. Anal lobe cerarii each with 2 conical setae about 25 μ long, 3 or 4 slender accessory setae about 65 μ maximum length, plus a concentration of around 40 to 45 trilocular pores, borne on a well-defined sclerotized area. Penultimate cerarii each with 2 slender conical setae about 16 μ maximum length, 2 or 3 slender accessory setae, plus a concentration of around 20 to 25 trilocular pores; surrounding derm not appreciably sclerotized. Anterior cerarii each usually with 2 slender conical setae about 15 μ long, some on anterior part of thorax, and those on head with 3 or 4 such conical setae; each with 2 to 4 slender accessory setae, plus a concentration of around 15–20 trilocular pores. Venter of anal lobe with an elongate area of light sclerotization; anal lobe seta about 185 μ long.

Dorsum with very few oral-rim tubular ducts, the unique holotype with but 1 such duct, about 10 μ diameter across rim, located on one side of mesothorax about midway between eighth cerarius and mediodorsal axis; specimen damaged at corresponding position on opposite side of body. Venter with a marginal band of numerous oral-collar ducts, mostly 4–5 μ diameter at orifice, extending from posterior apex of abdomen anteriorly to just behind eye, a few such ducts anterior to eye near base of antenna; these ducts most

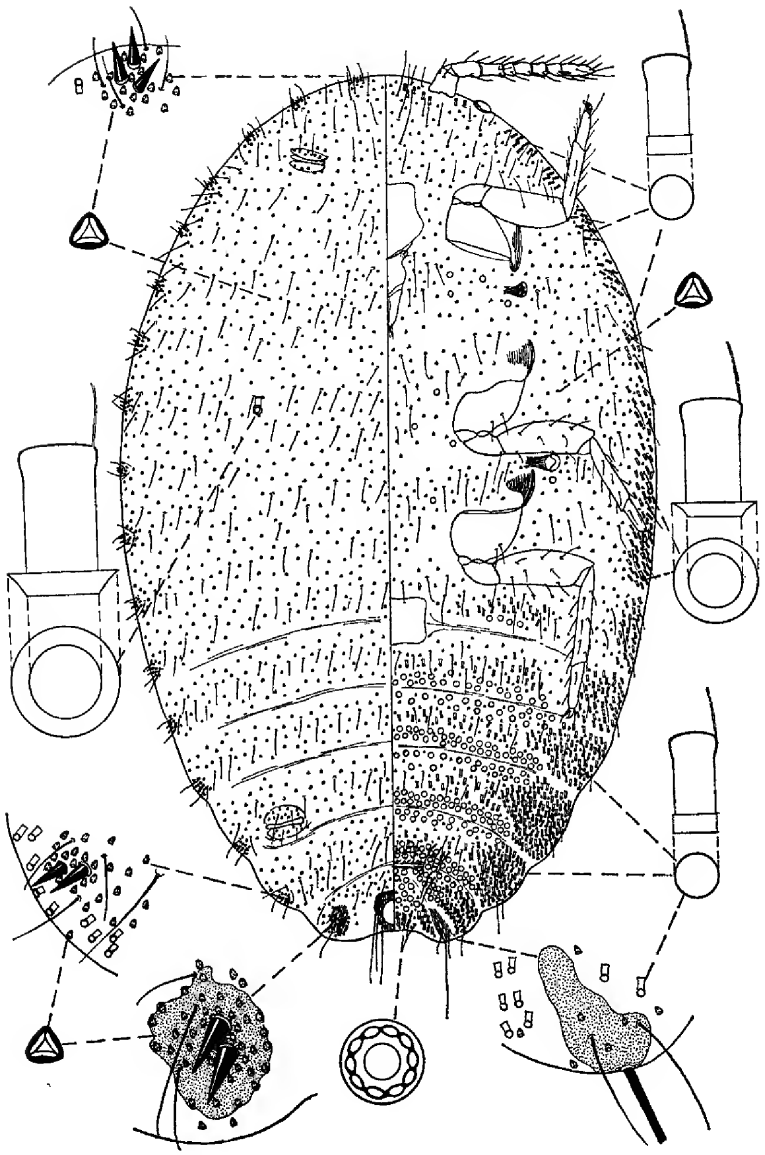

FIGURE 15.—*Pseudococcus multiductus*, adult female, dorsal and ventral aspects and details.

numerous on posterior abdominal segments, the band of ducts becoming narrower on segments anterior to circulus; a very few small rim tubular ducts, 7–8 μ diameter, located among oral-collar ducts on lateral margins of venter of metathorax. Abdominal segments 5 to 8 with sparse transverse bands of oral-collar ducts extending across each segment between bands of multilocular disc pores; abdominal segment 4 with a medially interrupted band of such ducts. Multilocular disc pores confined to venter, fairly numerous on abdominal segments 9 and 10, forming anterior and posterior marginal transverse bands on segments 6 to 8, a posterior marginal band on segment 5, and a short sublateral row on posterior margin of segment 4; a few multilocular pores scattered on venter of thorax. Trilocular pores moderately densely scattered on dorsum and venter. Body moderately sparsely clothed with fine setae; those of dorsum about 55 μ maximum length; those of venter somewhat longer, about 70 μ maximum length; long setae on venter of head anterior to mouthparts up to 100 μ long.

Holotype, female (US 67972), Ngerehelong, Babelthuap, Palau Is., Dec. 1947, Dybas.

DISTRIBUTION: Caroline Is. (Palau).

HOSTS: Unknown.

This species resembles *P. citriculus* in having relatively few dorsal oral-rim tubular ducts. It can be separated from *citriculus* by its more numerous oral-collar ducts which form a nearly continuous band along the lateral margins of the venter, and by the relatively short dorsal body setae.

41. Pseudococcus neomaritimus Beardsley, n. sp. (figs. 16; 21, *d*).

Pseudococcus comstocki: Fullaway 1946, B. P. Bishop Mus., Bull. **189**: 157 (misidentification).

Female. Moderately large; length of slide-mounted specimens about 2.2–2.8 mm.; anal lobes slightly protuberant. Antennae 8-segmented, about 450 μ long. Legs moderately long; hind femora about 250 μ in length; hind tibiae about 285 μ long, not appreciably swollen basally. Micropores apparently absent in hind coxae, trochanters, and femora, about 15 to 30 discernible on each hind tibia (fig. 21, *d*). Rostrum 150–160 μ long. Anal ring cellular, about 90 μ wide; bearing 6 setae, about 140 μ maximum length. Two pairs of dorsal ostioles present, their lips unsclerotized. Circulus of moderate size, extending across intersegmental fold between abdominal segments 4 and 5. Eyes of moderate size, about 28–30 μ diameter, with a weakly developed ocular cone; 2 to 5 small discoidal pores present along the posterior margin of each eye.

Normally with 17 pairs of marginal cerarii, 1 of the thoracic pairs occasionally wanting on one or both sides of the body in some specimens. Anal lobe cerarii each with 2 conical setae about 25 μ maximum length, 4 to 6 slender accessory setae about 45 μ maximum length, plus a concentration of around 40 trilocular pores, borne on an area of very weak sclerotization, definitely less strongly sclerotized than venter of anal lobes. Penultimate cerarii each with 2 small conical setae about 15 μ maximum length, 4 to 5 slender accessory setae, and a concentration of around 20 to 25 trilocular pores; surrounding derm unsclerotized. Anterior cerarii mostly with 2 conical setae about 12 μ long, those of head and anterior part of thorax usually with 3 or 4 such conical setae, 2 or 3 slender accessory setae and a slight concentration of about 12 to 15 trilocular pores. Venter of anal lobe with a well-developed, roughly triangular sclerotized area, bearing 3 or 4 small discoidal pores similar to those on margins of eyes in basal portion anterior to anal lobe seta; anal lobe seta about 130 μ long.

Oral-rim tubular ducts about 8–10 μ diameter across rim, fairly numerous on dorsum; usually 1 laterally near each cerarius on abdominal segments 4 to 8; 1 just behind each interantennal cerarius; and 1 near each of several of the anterior abdominal and thoracic cerarii; usually a total of about 8 to 12 in lateral series on each side; additional rim tubular

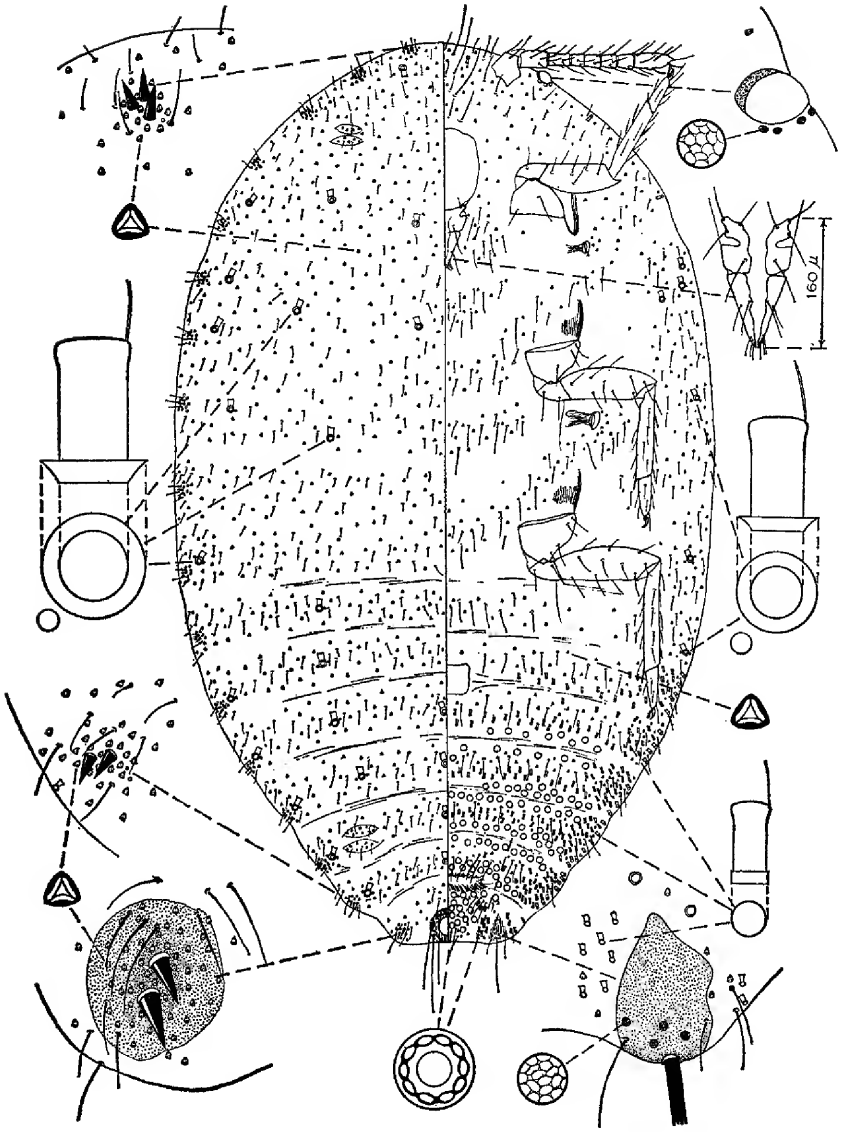

FIGURE 16.—*Pseudococcus neomaritimus*, adult female, dorsal and ventral aspects and details.

ducts on central region of thorax and abdomen as far caudad as abdominal segment 8; 1 to 5 such ducts per segment. Venter with a few oral-rim ducts along lateral margins on thorax and sometimes anterior abdominal segments. Small oral-collar ducts, 2–3 μ diameter at orifice, very numerous along lateral margins of venter, forming a band extending as far forward as abdominal segment 5; additional oral-collar ducts distributed in transverse bands across abdominal segments 5 to 8, and in a medially interrupted band on segment 4. Multilocular disc pores confined to venter, in transverse bands on posterior and anterior margins of abdominal segments 6 to 8, on posterior margin of segment 5, and behind vulva on segments 9 and 10; an occasional multilocular pore sometimes present on venter of anterior abdominal and thoracic segments. Trilocular pores moderately sparsely distributed on dorsum and venter. Body moderately sparsely clothed with fine setae; those of dorsum relatively short, about 15 μ maximum length; those of venter much longer, up to about 60 μ in length; longer setae on venter of head anterior to mouthparts up to about 150 μ long.

Holotype, female (US 67973), Yap Is. Yap, Aug. 24, 1950, Goss, on *Crotalaria incana*. Specimens from the following additional localities are designated as paratypes:

S. Mariana Is., Saipan, June 1946, Townes; Guam, Atao Beach, June 1936, Usinger, on cotton; Mt. Alutom, June 1946, Townes, on *Blechnum pyramidalum*; 1.6 km. s.e. Asan, alt. 180–240 m., Oct. 1947, Dybas; Barrigada, Nov. 1952, Gressitt, on *Hibiscus;* Jan. 1954, Liming. Yap, Yap Is., Aug. 1950, Goss, on *Crotalaria incana* (holotype). Wena (Moen), Truk, Oct. 1952, Beardsley, on *Acalypha indica*.

In addition, two slides are at hand from the Caroline Islands (locality unspecified), Sept. 1952, Krauss, on composite shrub.

DISTRIBUTION: S. Mariana Is. (Saipan, Guam), Caroline Is. (Yap, Truk).

HOSTS: Reported from *Acalypha*, *Blechnum*, cotton, *Crotalaria*, *Hibiscus*, and unidentified composite shrub.

Dr. Harold Morrison (personal communication) was of the opinion that forms such as *P. neomaritimus* which possess small sievelike discoidal pores on the margins of the eyes, and sometimes elsewhere on the body, are probably of Neotropical origin.

This mealybug is clearly allied to *P. maritimus* (Ehrhorn) and *P. obscurus* Essig, neither of which is represented among the Micronesian survey material studied. These two species recently were differentiated by Wilkey and McKenzie (1961 : 245) who utilized characters such as the numbers of micropores in the hind femora and tibiae, the shape of the hind tibiae, and the presence or absence of discoidal pores on the margins of the eyes. I have compared *P. neomaritimus* specimens with specimens from Ehrhorn's type lot of *P. maritimus* (material received on loan through the kindness of Dr. Harold Morrison), and with material from California and from Hawaii which conforms closely to the Wilkey-McKenzie concept of *P. obscurus*. From examination of this material, it is obvious that Micronesian specimens cannot be assigned to either *maritimus* or *obscurus* as these species have been defined by Wilkey and McKenzie. The following

key for separation of these closely related forms has been prepared from a study of the specimens at hand and from information given by Wilkey and McKenzie (1961).

KEY TO SOME SPECIES OF THE PSEUDOCOCCUS MARITIMUS COMPLEX

1. Hind femora each with 50 or more micropores; hind tibiae each with 80 or more micropores, slightly swollen toward middle; rostrum relatively elongate, around 180–190 μ in length ..... **obscurus**
   Hind femora each with 0 to 30 micropores; hind tibiae each with 15 to 30 micropores, not appreciably swollen toward middle; rostrum shorter, 160 μ or less 2
2. Hind femora apparently without micropores; with at least 1, usually 2 to 5 discoidal pores discernible on posterior margin of each eye ..... **neomaritimus**
   Hind femora with 12 to 30 micropores; discoidal pores on margin of eyes frequently wanting, 1 such pore occasionally discernible ..... **maritimus**

The presence of discoidal pores on the posterior margin of the eyes will serve to distinguish *P. neomaritimus* from all other known Micronesian forms here assigned to *Pseudococcus*. Similar pores occur on two species here placed in *Dysmicoccus* (*D. brevipes* and *D. neobrevipes*).

42. Pseudococcus orchidicola Takahashi (fig. 17).

Pseudococcus orchidicola Takahashi, 1939, Tenthredo **2** (3) : 242, fig. 3.

DISTRIBUTION: S. Mariana Is. (type locality: Rota), Caroline Is., Marshall Is., Gilbert Is.

S. MARIANA IS. SAIPAN: Talofofo Ridge, Jan. 1945, Dybas, beating vegetation; As Mahetog area, Jan. 1945, Dybas, beating vegetation; As Mahetog, Feb. 1945, Dybas, on decaying *Pandanus* leaf; Mar. 1945, Dybas, on *Pandanus*. TINIAN: Mar. 1945. E. Hagen. ROTA: Sabana, Nov. 1937, Esaki, on orchid (type series); Sabana, June 1946, Townes, on *Pandanus tectorius*.

CAROLINE ATOLLS. EAURIPIK: June 1958, Tellei, on *Cyrtosperma*. NUKUORO: Shenukdei I., Aug. 1946, Oakley, on *Cyrtosperma chamissonis*. SATAWAN: Satawan I., Nov. 1952, Beardsley.

TRUK. FEFAN: May 1946, Oakley, on taro.

KUSAIE. Lele, Aug. 1946, Oakley, on *Pandanus tectorius*.

MARSHALL IS. WOTHO: Wotho I., Feb. 1952, Fosberg (802), inhabiting *Pandanus* fruit. UJAE: Ebeju I., Mar. 1952, Fosberg (1021), in axils of *Pandanus* leaves. KWAJALEIN: Aug. 1946, Oakley, on *Pandanus tectorius*; in quarantine at Honolulu, Uyeda and Makino, Aug. 1949, on *Pandanus* sp. JALUIT: Jabwar (Jabor) I., May 1958, Gressitt, on *Pandanus*. NAMORIK: Namorik I., Sept. 1953, Beardsley, on *Pandanus* fruit. UTIRIK: Utirik I., Nov. 1951, Fosberg (128), in axils of dead lower leaves and green leaves just above them on *Pandanus*. AILUK: Ailuk I., Dec. 1951, Fosberg (493),

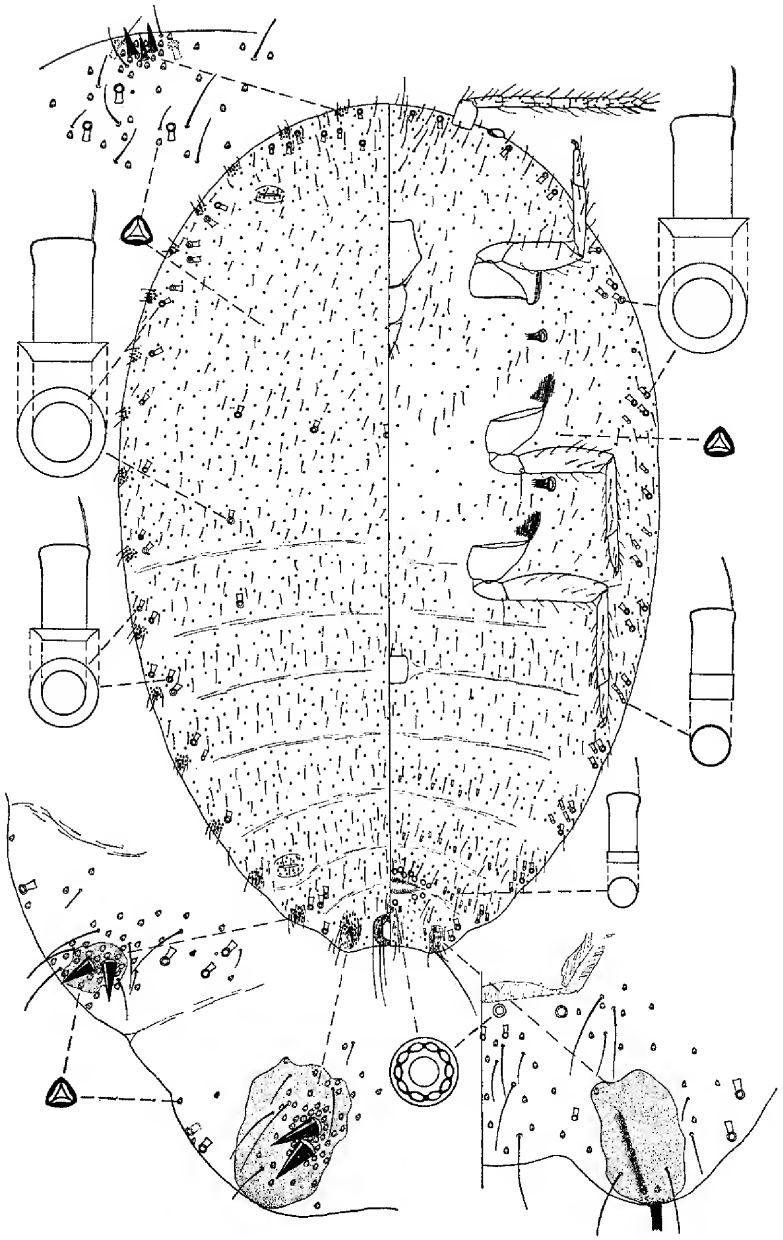

FIGURE 17.—*Pseudococcus orchidicola*, lectotype female, dorsal and ventral aspects and details.

coconut grove near center of island. LIKIEP: Likiep I., Aug. 1946, Oakley, on taro. MAJURO: Majuro I., Aug. 1946, Oakley, on *Pandanus tectorius*; Uliga I., Dec. 1955, Stone, on *Pandanus* fruit. ARNO: June 1950, La Rivers, in cracks on *Pandanus* and on *Pandanus*; July 1950, La Rivers, on banana plant; in quarantine at Honolulu, Sept. 1951, D. F. Chong, on *Pandanus* sp. MILI: Oct. 1953, Beardsley, on *Pandanus* fruit.

GILBERT IS. TARAWA: Aug. 1956, Brown, on *Cyrtosperma chamissonis*.

HOSTS: Banana, *Cyrtosperma chamissonis* (giant taro), orchid, *Pandanus*, taro.

In order to characterize this species properly, Takahashi's type material (5 specimens on one slide designated collectively as cotypes) was restained and remounted on four slides. One of Takahashi's specimens has been designated a lectotype, and the remaining four as paratypes.

Takahashi's description states that the "ventral cicatrix" or circulus is absent in this species; however, a circulus was found in all specimens of the type series upon restaining. Takahashi makes no mention of the presence of dorsal oral-rim tubular ducts or dorsal oral-collar ducts, although such ducts are present in the type material. Usually there are 1 to 3, occasionally 4, rim tubular ducts laterally on the dorsum near most of the abdominal and thoracic cerarii. In the type specimens there are generally 5 to 9 oral-rim tubular ducts of different sizes associated with each cerarius; some dorsal, some ventral, and some lateral with respect to a given cerarius. There are also a few oral-rim ducts on the central portions of the dorsum of the thorax and anterior abdominal segments. In some of the specimens which are here assigned to *P. orchidicola* the number of dorsal oral-rim ducts may be reduced to 1 or 2 per cerarius, or these may be replaced to some extent by large oral-collar ducts. With very few exceptions, all specimens have from 5 to 9 large tubular ducts, either oral-rim or oral-collar or both, grouped around each interantennal cerarius. This character, and the presence of relatively numerous tubular ducts along the lateral margins of the venter, will differentiate *P. orchidicola* from related forms such as *P. trukensis*, *P. marshallensis*, and *P. solomonensis*. In addition, the last named species has very few dorsal tubular ducts, not more than 8 in Micronesian specimens studied.

In many of the specimens here assigned to *P. orchidicola*, micropores are discernible on the mesofemora as well as on the metafemora and metatibiae. A few such mesofemoral micropores are present in specimens of the type series, and nearly all specimens from *Pandanus* and banana from the Marshall Islands possess an even greater number of mesofemoral micropores. One or two Marshall Islands specimens from *Pandanus*, and some from the Marianas, as well as several from taro or *Cyrtosperma* from the Marshalls, Gilberts, and Carolines, show very few such pores, or none. Other specimens from *Cyrtosperma* (for example, from Eauripik Atoll), possess about as

many mesofemoral micropores as do specimens of the type series. That the possession of mesofemoral micropores is not a constant character in this species is indicated by their occurrence in one mesofemur and not the other in at least one specimen. Micropores similar to those of the hind legs and mesofemora are present, scattered sparsely on the ventral derm, particularly of the thorax, in the type specimens and most others assigned here to *P. orchidicola*.

43. Pseudococcus pandanicola Takahashi.

Pseudococcus pandanicola Takahashi, 1939, Tenthredo **2** (3) : 248, fig. 5.

DISTRIBUTION: Caroline Is. Endemic?

PALAU. BABELTHUAP: Ngaremeskang (Ngarumisukan), Dec. 1952, Gressitt; Ulimang, Dec. 1947, Dybas, in axils of *Pandanus*; Cacao Plantation near Imeliik, Aug. 1953, Beardsley, on *Freycinetia* sp. KOROR: Jan. and Mar. 1954, Beardsley, on *Pandanus* leaves; July 1956, McDaniel, on *Pandanus*. "Southern Group": Aug. 1945, Dybas.

HOSTS: Pandanaceae (*Pandanus* and *Freycinetia*).

This species may be distinguished readily from other Micronesian species of *Pseudococcus* by the development of the cerarii. Each one of the 17 pairs of cerarii is borne on a moderately well defined sclerotized area. In addition, the basal segment of each antenna is incised or notched on its inner face near the base. Otherwise, the species appears to be a fairly typical *Pseudococcus*.

44. Pseudococcus solomonensis Williams (fig. 18).

Pseudococcus solomonensis Williams, 1960, Brit. Mus. (Nat. Hist.) Ent. Bull. **8** (10) : 426, fig. 18.

DISTRIBUTION: Solomon Islands (type locality), Caroline Is.

PALAU. BABELTHUAP: July 1946, Townes, on *Artocarpus integer* (= *A. heterophyllus*) and *Eugenia* (?); Ulimang, Dec. 1947, Dybas, in cut decaying crown of betel palm. KOROR: Nov. 1947, Dybas, on large leaf taro; June 1953, Beardsley, on *Macaranga* sp.; Feb. 1954, Beardsley, on fruit of *Eugenia* sp.

YAP. YAP: Oct. 1952, Krauss, on fruit of wild *Ficus*. RUMUNG: Aug. 1950, Goss. E. MAP: Aug. 1950, Goss.

TRUK. WENA (Moen): Feb. 1948, Maehler, on dead tree; Feb. 1949, Potts, on unidentified root. TONOAS (Dublon): May 1946, Townes, on *Randia carolinensis* or *Macaranga carolinensis*.

PONAPE. Nanpohnmal, 50 m., Jan. 1953, Gressitt.

HOSTS: Reported from cacao and wild bananas in the Solomon Is. (Williams 1960 : 426). In Micronesia it has been taken on jackfruit (*Artocarpus heterophyllus*), *Ficus*, *Eugenia*, *Macaranga*, betel palm, and "large leaf taro."

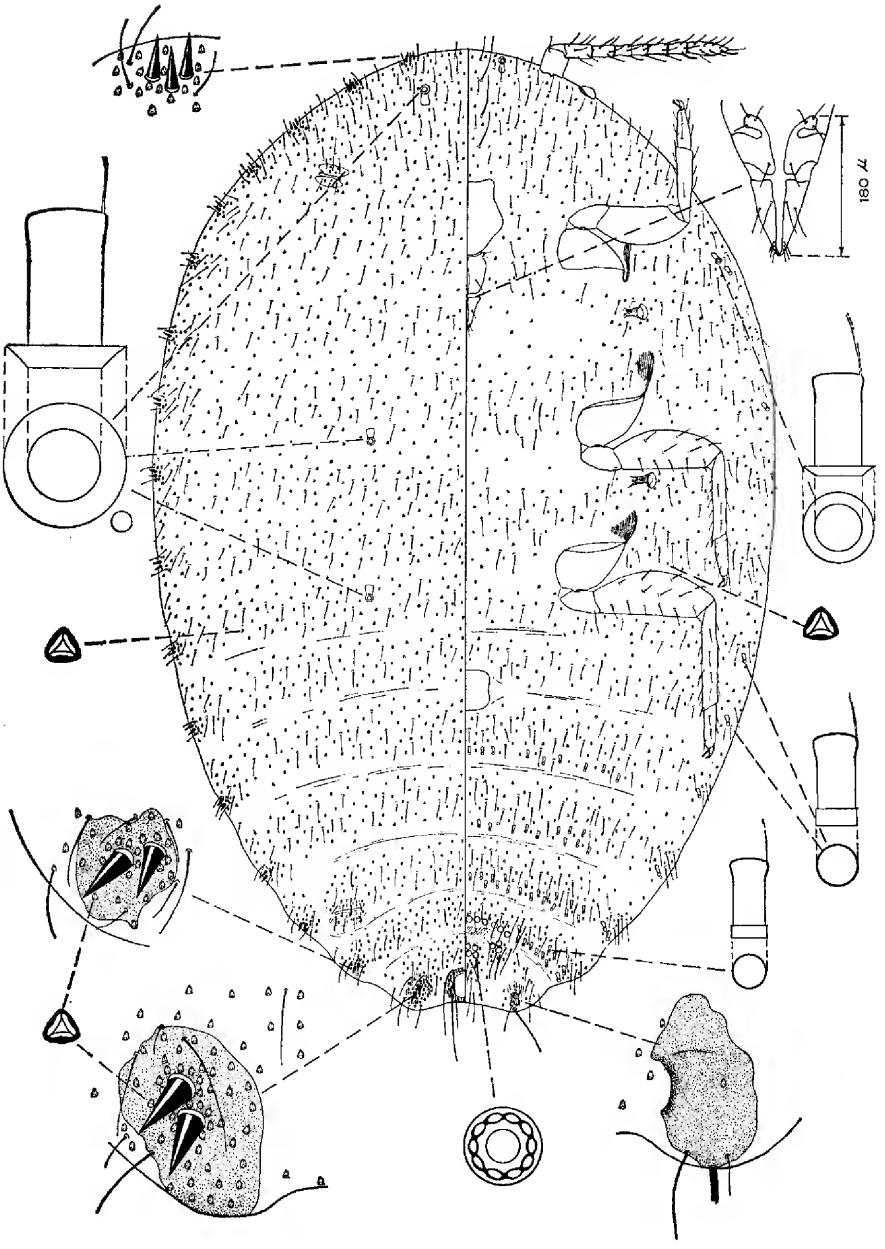

FIGURE 18.—*Pseudococcus solomonensis*, adult female, dorsal and ventral aspects and details.

This species may be separated from other similar Micronesian forms by the reduced number of oral-rim tubular ducts on the dorsum. The maximum number of such ducts in the Micronesian specimens at hand is 8, the usual number being 6 or fewer. The pair of oral-rim ducts situated one behind each interantennal cerarius is frequently reduced to a single duct on one side or the other, or is completely absent. In one or two specimens, dorsal rim tubular ducts appear to be completely absent, although they are present in other specimens from the same collections. The rostrum is relatively elongate in this species, measuring about 170–180 μ in length in Micronesian specimens.

Dr. D. J. Williams kindly provided a paratype specimen of *P. solomonensis* for comparison with Micronesian material. This specimen differs from the Micronesian examples in having longer, more slender legs and slightly longer antennae. However, there is a considerable range in length of appendages among the specimens from Micronesia, and in all the rostrum is about the same length as in the Solomon Islands specimen. Eventually it may be possible to demonstrate that the Micronesian material here assigned to *P. solomonensis* represents one or more distinct species or subspecies. Until additional material from other Pacific areas, preferably including males, can be studied it does not seem wise to attempt the differentiation of Micronesian segregates.

45. Pseudococcus trukensis Beardsley, n. sp. (fig. 19).

Female. Size moderate, length of slide-mounted specimens 2.2 to 2.7 mm.; body elongate-oval; anal lobes moderately protuberant. Antennae 8-segmented, elongate, about 640 μ long. Legs moderately large and elongate; hind femora about 365 μ long; hind tibiae about 375 μ long. Hind coxae without micropores; hind femora with about 10 to 30 discernible on upper surface; hind tibiae with about 10 to 20. Rostrum 170–185 μ long. Anal ring cellular, about 100–105 μ wide, bearing 6 setae about 200 μ maximum length. Two pairs of dorsal ostioles present, their lips unsclerotized. Circulus large, about 40 μ diameter; with a moderately well-developed ocular cone; without paraocular discoidal pores. With 17 pairs of marginal cerarii. Anal lobe cerarii each with 2 large conical setae about 36 μ maximum length, plus 5 or 6 slender accessory setae about 90 μ maximum length, surrounded by a moderately heavy concentration of around 80 to 100 trilocular pores, and borne on a well-developed sclerotized area. Penultimate cerarii each with 2 conical setae about 30 μ long plus 4 to 6 slender accessory setae about 60 μ maximum length, surrounded by a concentration of around 55 to 60 trilocular pores, and borne on a moderately well-defined sclerotized area. Antipenultimate cerarii each with 2 conical setae about 25 μ long, plus 4 to 6 slender accessory setae about 45 μ maximum length and a concentration of around 25 trilocular pores; surrounding derm unsclerotized. Anterior cerarii mostly with 2 conical setae, except those of head and anterior part of thorax frequently with 3 to 5 such setae, about 25 μ maximum length, plus 2 to 5 slender accessory setae and a small concentration of trilocular pores; the derm unsclerotized. Venter of anal lobes with a well-developed, elongate, sclerotized area, with a definitely more heavily sclerotized strip near the mesal border. Anal lobe seta about 160–180 μ long.

Oral-rim tubular ducts fairly numerous on dorsum, of two sizes, the larger 11–12 μ diameter across rim, the smaller about 7–9 μ diameter across rim. Usually with 1 larger type oral-rim duct laterally near each penultimate cerarius, 1 near each of several anterior cerarii, and 1 nearly always just behind each interantennal cerarius. One of the smaller

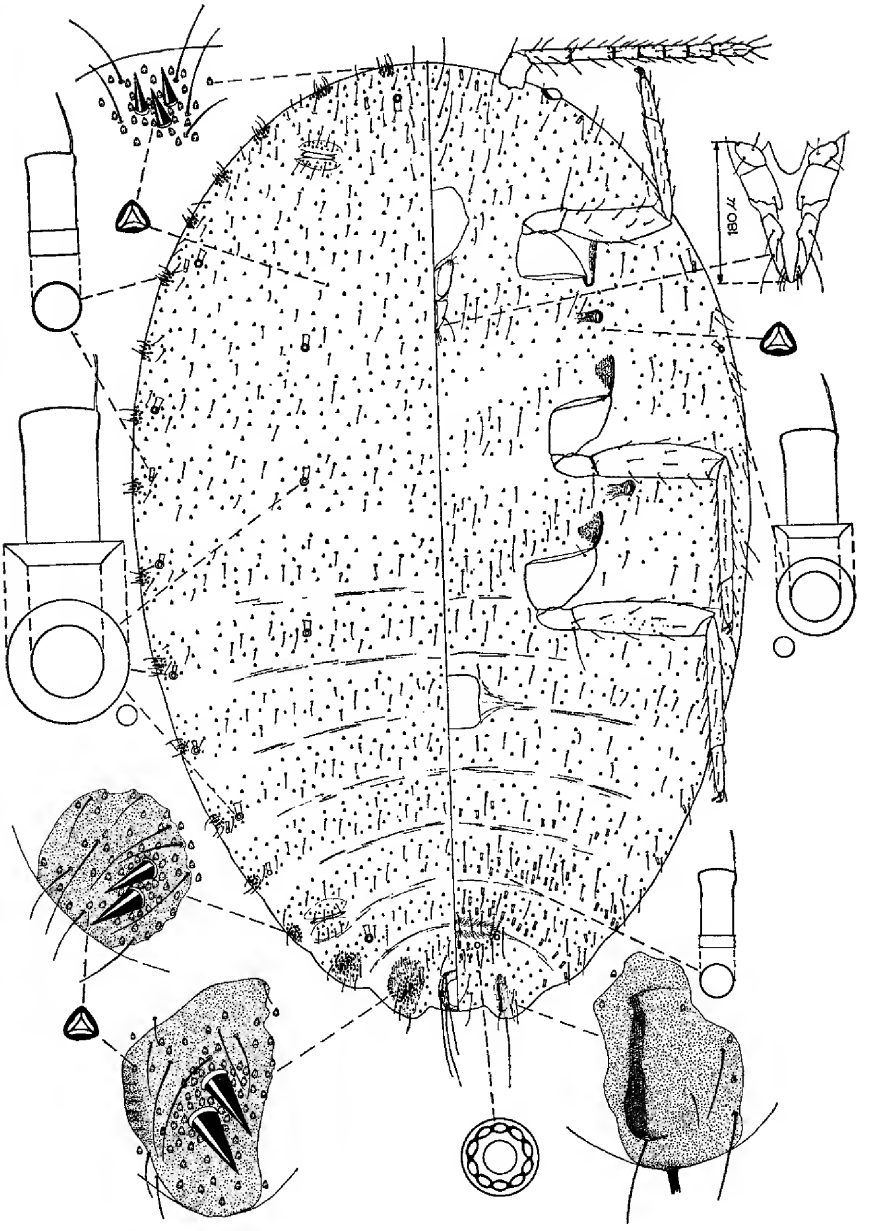

FIGURE 19.—*Pseudococcus trukensis*, adult female, dorsal and ventral aspects and details.

oral-rim ducts, or occasionally an oral-collar tubular duct about 7 μ diameter, takes the place of a large oral-rim duct near a few to most of the cerarii; sometimes with 1 large and 1 small oral-rim duct, 2 small oral-rim ducts, or an oral-rim and an oral-collar duct near a few cerarii. Usually with a few of the larger oral-rim ducts on the central part of the dorsum of the thorax and (or) anterior abdominal segments. Venter with fairly numerous small oral-collar tubular ducts, 3–4 μ diameter at orifice, distributed across abdominal segments 6 to 8, plus a few behind vulva on segment 9; a few somewhat larger oral-collar ducts, 5–6 μ diameter, or small oral-rim ducts ventrally along lateral margins near cerarii of thorax and abdomen, and usually 2 or 3 such ducts ventrally on head beneath each interantennal cerarius. Multilocular disc pores reduced to a very few on margins of vulva, or sometimes apparently wanting; not more than 4 discernible in any of the specimens at hand. Trilocular pores evenly, fairly densely scattered over dorsum and venter. Body moderately sparsely clothed with short fine setae; those of dorsum about 42 μ maximum length; those of venter about 70 μ maximum length; longer setae on venter of head anterior to mouthparts about 110 μ maximum length.

Holotype, female (BISHOP 6142), Wena (Moen), Truk, Feb. 20, 1954, Beardsley, on breadfruit leaves; 2 paratypes (US, UH), on 2 slides, same data as type. Additional specimens: Pigue I., Faraulep, Caroline Atolls, Sept. 1952, Krauss, on *Messerschmidia* (*Tournefortia*). Wena (Moen), Truk, Feb. 1954, Beardsley, on *Hibiscus tiliaceus*, *Nothopanax scutellarium*, and breadfruit; Tonoas (Dublon), May 1946, Oakley, on orange; Mt. Unibot, Ton (Tol), 390 m., Feb. 1953, Gressitt. Ponape, 1 km. s. of airfield, Aug. 1950, Adams.

DISTRIBUTION: Caroline Is. (Faraulep, Truk, Ponape).

HOSTS: Recorded from breadfruit, citrus (orange), and the common strand shrubs *Messerschmidia* and *Hibiscus tiliaceus*.

In addition, one slide bearing two specimens of this species, labeled only "Micronesia No. 345" (Truk Is., May 1946, Oakley) is among the survey material studied.

Unfortunately, no males of this species have been available for study. However, several females, including the holotype, contain male sperm bundles, which are similar in form to those of a male included in a lot of females determined by me as *P. orchidicola* Takahashi. In these sperm bundles, the helix formed by the spiral anterior portion is relatively loose, having a lead of about 6 μ. In *P. adonidum* and *P. microadonidum* on the other hand, the sperm bundles form a much more tightly coiled helix, with a lead of about 1.5 μ. This suggests that *P. trukensis* may be more closely allied to *P. orchidicola* than to *P. adonidum*, although females seem to resemble the latter species rather closely.

Females of *P. trukensis* may be separated from those of *P. adonidum* and *P. marshallensis*, which they resemble, by the characters stressed in the key to Micronesian species of *Pseudococcus*. *P. adonidum* possesses more numerous oral-rim tubular ducts near the cerarii, greater concentrations of trilocular pores on anal lobe and penultimate cerarii, more strongly sclerotized penultimate cerarii, shorter appendages (rostrum about 150 μ in *adonidum*, 170–185 μ in *trukensis*), more numerous micropores in hind femora

and tibiae, and more numerous multilocular pores around the vulva than does *P. trukensis*. *P. marshallensis* has shorter appendages, more numerous multilocular disc pores, and somewhat more numerous oral-rim tubular ducts dorsally along lateral margins near the cerarii than *trukensis*.

46. Pseudococcus yapensis Beardsley, n. sp. (fig. 20).

Female. Size moderate, length of slide-mounted specimens 2.2–2.6 mm.; body elongate-oval; anal lobes only slightly protruding. Antennae 8-segmented, moderately elongate, about 630 μ long. Legs moderately large and elongate; hind femora about 300 μ long, hind tibiae around 300 μ long. Hind coxae without discernible micropores; hind femora each with about 25 to 40 micropores, hind tibiae with about 30 to 45 such micropores. Rostrum 135–145 μ long in available specimens. Anal ring cellular, about 100 μ wide; with 6 setae about 160 μ maximum length. Two pairs of dorsal ostioles present, their lips unsclerotized. Circulus moderately large, extending across intersegmental fold between abdominal segments 4 and 5. Eyes of moderate size, about 27 μ diameter; ocular cone moderately well-developed; paraocular discoidal pores absent.

With 17 pairs of marginal cerarii. Anal lobe cerarii each with 2 moderately large conical setae, about 27 μ long, plus 4 or 5 slender accessory setae, and a moderately dense concentration of around 60 trilocular pores, borne on a well-developed sclerotized area. Penultimate cerarii each with 2 conical setae about 24 μ maximum length, plus 4 or 5 slender accessory setae and a concentration of around 30 to 35 trilocular pores; the surrounding derm weakly or hardly sclerotized. Anterior cerarii mostly with 2 conical setae about 15 μ maximum length, those of head and anterior part of thorax frequently with 3, sometimes with 1 or 4 such conical setae, plus 1 to 3 slender accessory setae and surrounded by a concentration of around 15 to 20 trilocular pores; surrounding derm unsclerotized. Venter of anal lobes with a well-defined elongate sclerotized area with a longitudinal band of heavier sclerotization near its mesal border. Anal lobe setae broken off in all available specimens.

Oral-rim tubular ducts not very plentiful on dorsum, 14 to 18 in available specimens; of fairly large size, 10–12 μ diameter across rim; these apparently confined to lateral margins of body near cerarii; usually 1 such duct near each penultimate cerarius, 1 behind each interantennal cerarius, and 1 by each of several of the cerarii anterior to the antipenultimate. Ventral tubular ducts relatively few, several very small oral-collar ducts, oral diameter about 3 μ, present about vulva and across abdominal segments 5 to 7; tubular ducts almost entirely wanting on lateral areas of venter (1 large oral-rim tubular duct present on margin of venter between eighth and ninth cerarii on one side of one specimen). Multilocular disc pores confined to margins of vulva, 11 to 17 present in available specimens. Trilocular pores evenly, moderately densely scattered on dorsum and venter. Body moderately sparsely clothed with short fine setae, those of dorsum about 27 μ maximum length, those of venter about 50 μ maximum length.

Holotype, female (US 67974) and 1 paratype on one slide, Ruul District, Yap, Yap Is., Aug. 17, 1950, Goss, no host. Two paratypes (BISHOP) on one slide, same data.

DISTRIBUTION: Caroline Is. (Yap).

Pseudococcus yapensis may be separated from all of the other Micronesian forms resembling *P. adonidum* by the virtually complete absence of tubular ducts ventrally along the lateral margins. In addition, the rostrum is slightly shorter in most of the similar Micronesian forms, except for two species, *P. microadonidum* and *P. kusaiensis*, both of which have more numerous tubular ducts dorsally as well as ventrally.

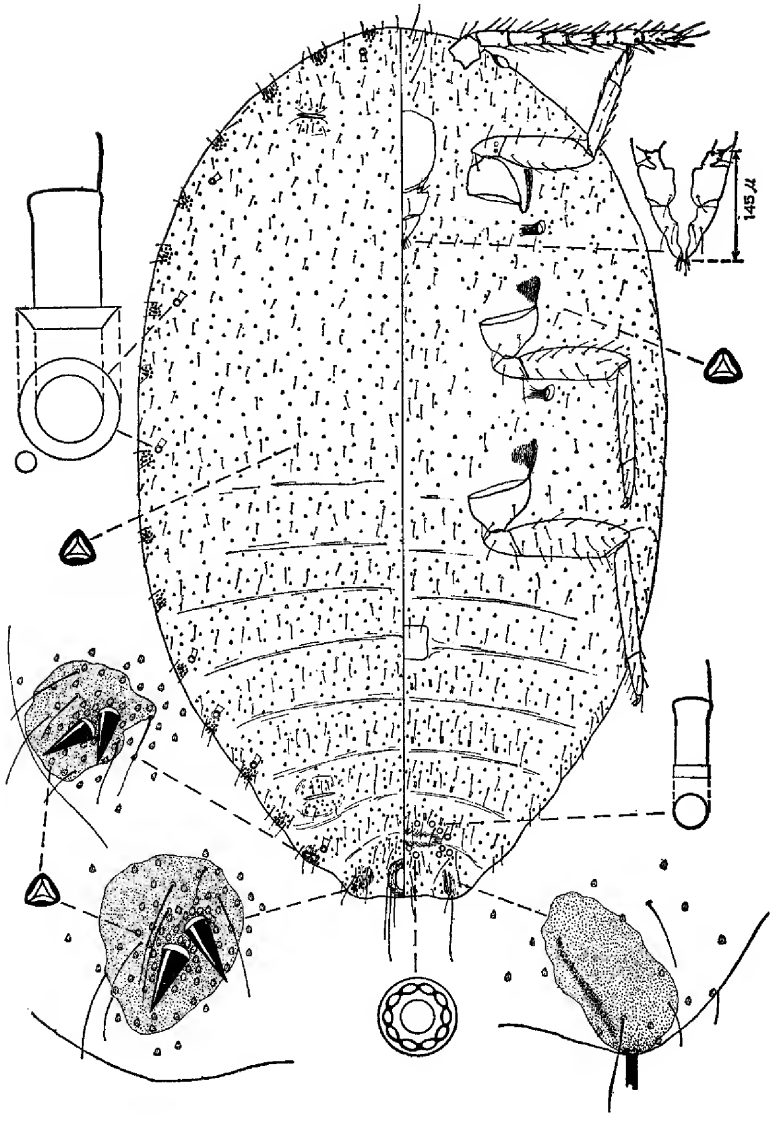

FIGURE 20.—*Pseudococcus yapensis*, adult female, dorsal and ventral aspects and details.

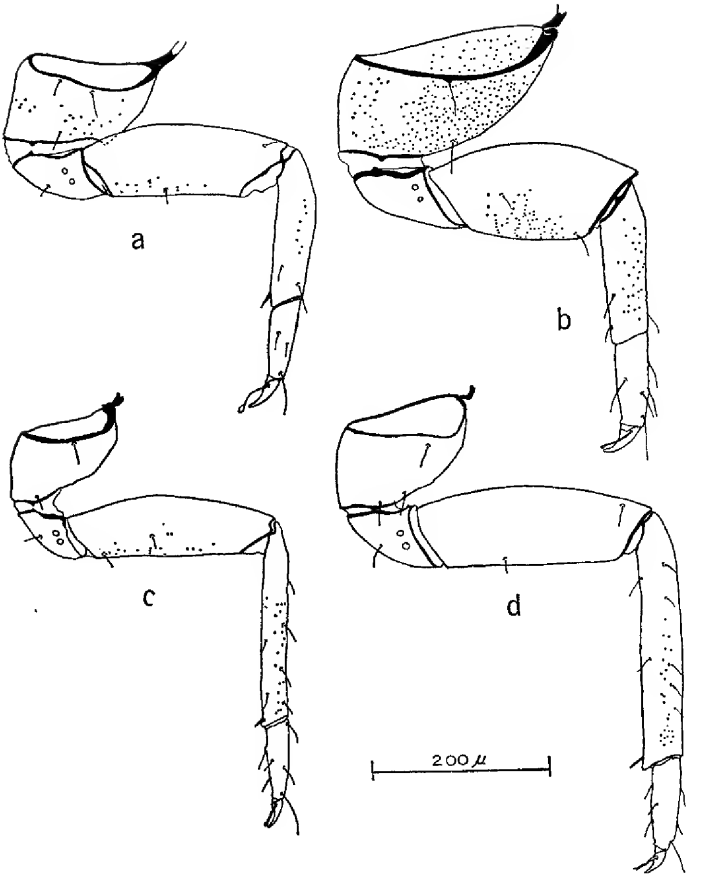

FIGURE 21.—Upper surfaces of hind legs showing distribution of micropores: **a**, *Dysmicoccus saipanensis*; **b**, *Paraputo leveri*; **c**, *Pseudococcus microadonidum*; **d**, *P. neomaritimus*.

Genus **Rhizoecus** Künckel d'Herculais

Rhizoecus Künckel d'Herculais, 1878, Ent. Soc. France, Ann. V, **8**: 163.—Hambleton, 1946, Rev. de Ent. [Rio de Janeiro] **17**: 50.—Ferris, 1953, Atlas Scale Ins. North America. **6**: 426.
Morrisonella Hambleton, 1946, Rev. de Ent. **17**: 16 (preoccupied).
Coccidella Hambleton, 1946, Biol. Soc. Washington, Proc. **59**: 177.

Type of genus: *Rhizoecus falcifer* Künckel d'Herculais.

This, as yet, poorly known group of hypogaeic mealybugs is represented in Micronesian material available for this study by two apparently undescribed forms. One of these has also been collected recently in Hawaii.

KEY TO MICRONESIAN SPECIES OF RHIZOECUS

Circulus present; body bearing tritubular pores; antennae 6-segmented, relatively elongate ..... **advenus**
Circulus absent; body bearing bitubular pores; antennae 5-segmented, relatively short and stout ..... **carolinensis**

47. Rhizoecus advenus Beardsley, n. sp. (fig. 22).

Female. Length of slide-mounted specimen about 1.3 mm.; body form elongate. Antennae 6-segmented, moderately slender, about 180 μ long; apical segment with 4 finger-like sensory setae; penultimate segment with 1 such seta. Legs moderately small; hind femora about 95 μ long; hind tibiae about 80 μ long, with 3 stout spinelike setae at apex; hind tarsal claw about 24 μ long, with a pair of slender digitules extending nearly to apex of claw. Rostrum about 75 μ long. Anal ring cellular, about 37 μ wide; bearing 6 setae about 55 μ maximum length. Two pairs of dorsal ostioles present, their lips moderately well sclerotized. Circulus in form of a truncate cone, always present on abdominal segment 4, size somewhat variable, about 22 μ wide at base in type, apex loculate; a second similar but smaller circulus on a few specimens in type lot, usually wanting. Eyes present, small, around 10 μ diameter. Venter of head with a small, roughly triangular area of weak sclerotization anterior to mouthparts.

True cerarii absent; dorsum of anal lobes with 2 long, relatively stout setae about 45 μ maximum length; surrounding derm unsclerotized. Venter of anal lobes unsclerotized; anal lobe seta about 60 μ long.

Dorsum with a few small tubular ducts, each with a weak oral rim, about 4 μ diameter across rim, on segments of thorax and abdomen, not more than 4 or 5 discernible on any segment. Venter with a few such tubular ducts near lateral margins, 1 or 2 on each of most abdominal segments, and 1 near eye on head. Tritubular pores each about 7.5 μ wide, with individual orifices about 3 μ diameter, fairly numerous on dorsum, somewhat fewer on venter; transverse rows of 7 to 9 such pores on dorsum of thorax and abdominal segments 2 to 6; transverse rows of about 6 such pores on venter of these segments. Multilocular disc pores confined to posterior portion of venter; 30 to 50 around margins of vulva; 15 to 20 in a transverse row across posterior margin of abdominal segment 7. Trilocular pores about 3 μ wide, moderately densely scattered on dorsum and venter. Body moderately sparsely clothed with fine setae; those of dorsum about 15 μ maximum length; those of venter about 25 μ maximum length.

Holotype, female (BISHOP 6143) and 2 paratypes on one slide; Experiment Station, HSPA, Honolulu, Hawaii, July 27, 1959, Beardsley, on roots of *Cordyline terminalis*. Seventeen paratypes (BISHOP, UH, US) on seven slides, same data as holotype. One somewhat teneral specimen from Mt. Unibot, Ton (Tol) I., Truk, 10 m., Jan. 1953, Gressitt, ex Berlese funnel.

DISTRIBUTION: Hawaii (type locality), Caroline Is. (Truk).

HOST: Found infesting roots of ti (*Cordyline terminalis*) in Hawaii.

This species is close to *R. amorphophalli* Betrem (1940 : 267), described from Java, and eventually may be found to be identical. *R. advenus* differs from Betrem's description of *amorphophalli* in possessing a single ventral circulus on abdominal segment 4 in most specimens, although a few have a second, much smaller circulus on segment 5. *R. amorphophalli* is described as possessing 2 circuli, and from Betrem's figure it appears that these are of about equal size. Betrem makes no mention of small dorsal and ventral tubular ducts, but these might easily have been overlooked.

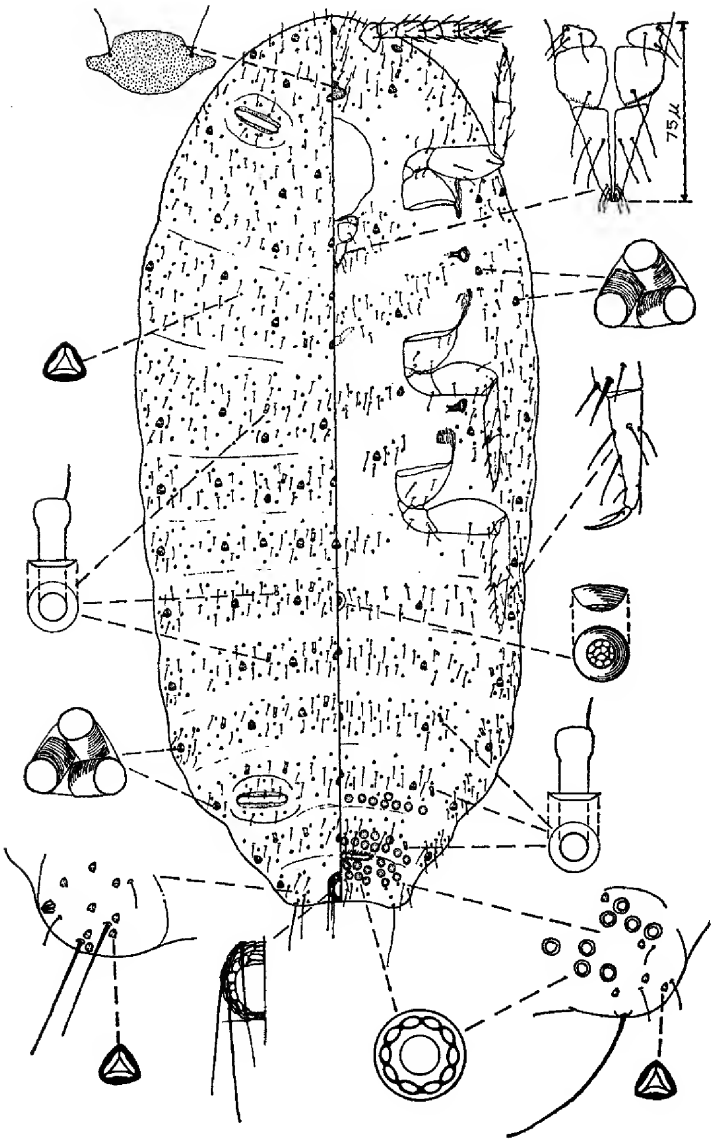

FIGURE 22.—*Rhizoecus advenus*, adult female, dorsal and ventral aspects and details.

At my request, Dr. Harold Morrison compared a slide preparation from the type lot of *R. advenus* with a specimen of *R. amorphophalli* from Java, determined by Hambleton, which is in the U.S. National Coccid Collection, and he noted (personal communication) that the tritubular pores are somewhat smaller and more numerous in the latter than in *advenus*. The presence of tubular ducts in *amorphophalli* was not ascertained.

48. Rhizoecus carolinensis Beardsley, n. sp. (fig. 23).

Female. Size small; length of slide-mounted specimen about 0.8 mm.; body form elongate-oval. Antennae 5-segmented, relatively stout, about 135 μ long; apical segment with 3 or 4 thick and 1 thinner finger-like sensory setae; wanting on penultimate segment. Legs short and stout; hind femora about 90 μ long by 42 μ maximum width; hind tibiae about 70 μ long; tarsal claws elongate, those of hind legs about 27 μ long, the digitules short, fine, reaching halfway to apex of claw or less. Legs without discernible micropores. Rostrum about 75 μ long. Anal ring cellular, about 40 μ wide; bearing 6 setae about 54 μ maximum length. Two pairs of dorsal ostioles present, their lips not appreciably sclerotized. Circulus of the usual type absent; a transparent, circulus-like area present immediately behind vulva on abdominal segment 9. Eyes not discernible. True cerarii absent; dorsum of anal lobe with 2 elongate setae about 54 μ maximum length; derm unsclerotized. Venter of anal lobe unsclerotized; anal lobe seta about 57 μ long. Venter of head with a small sclerotized patch bearing 2 setae situated anterior to the mouthparts.

Tubular ducts of oral-rim or oral-collar type apparently absent. Bitubular pores present on dorsum and venter, around 20 to 25 on dorsum, arranged in a marginal series of 1 pore on each side of most abdominal and thoracic segments, a medio-dorsal series of 4 to 5 pores, including 1 near anterior margin of head, and 1 or 2 sublaterally on thorax and anterior part of abdomen. Venter with 5 to 8 bitubular ducts on each of abdominal segments 5 to 9, 1 to 3 near each lateral margin, 1 sublaterally on each side, and 1 midventrally on most of these segments. Dorsal bitubular ducts noticeably larger than those of venter, the former about 7.5 μ wide, the latter about 5 μ wide. Multilocular disc pores confined to venter, 25 to 30 around vulva on abdominal segments 8 to 10, a row of 8 to 10 along posterior margins of segments 5 to 7, plus 2 to 3 on each side near lateral margins of these segments; 1 or 2 on posterior margin of abdominal segment 4; 3 or 4 on venter of thorax. Trilocular pores moderately sparsely scattered on dorsum and venter. Body moderately densely clothed with fine setae; those of dorsum mostly about 20 μ maximum length, a few on posterior part up to 25 μ long; those of venter about 15 μ maximum length; longer setae present on lateral margins of abdominal segments dorsally, up to about 30 μ maximum length on penultimate abdominal segment.

Holotype, female (US 67975), Hill 1010, Kusaie, 300 m., Feb. 1953, Clarke, ex forest leaves and trash. Paratype (BISHOP), Mt. Matante, Kusaie, 580 m., Feb. 1953, Clarke, on forest floor. A single teneral specimen still within preadult exuvium, from Mt. Unibot, Ton (Tol) I., Truk, Jan. 1953, Gressitt, native forest, ex Berlese funnel, is tentatively placed here.

DISTRIBUTION: Caroline Is. (Truk, Kusaie).

HOSTS: Unknown.

R. carolinensis is perhaps allied to *R. kondonis* Kuwana and *R. campestris* Hambleton, both of which lack eyes and have 5-segmented antennae and bitubular pores. Both these species possess multiple circuli, however. *R. carolinensis* also resembles *R. americanus* (Hambleton), as defined by Ferris (1953 : 428), and *R. eluminatus* McKenzie, except that both the latter have tritubular rather than bitubular ducts, and 6-segmented antennae.

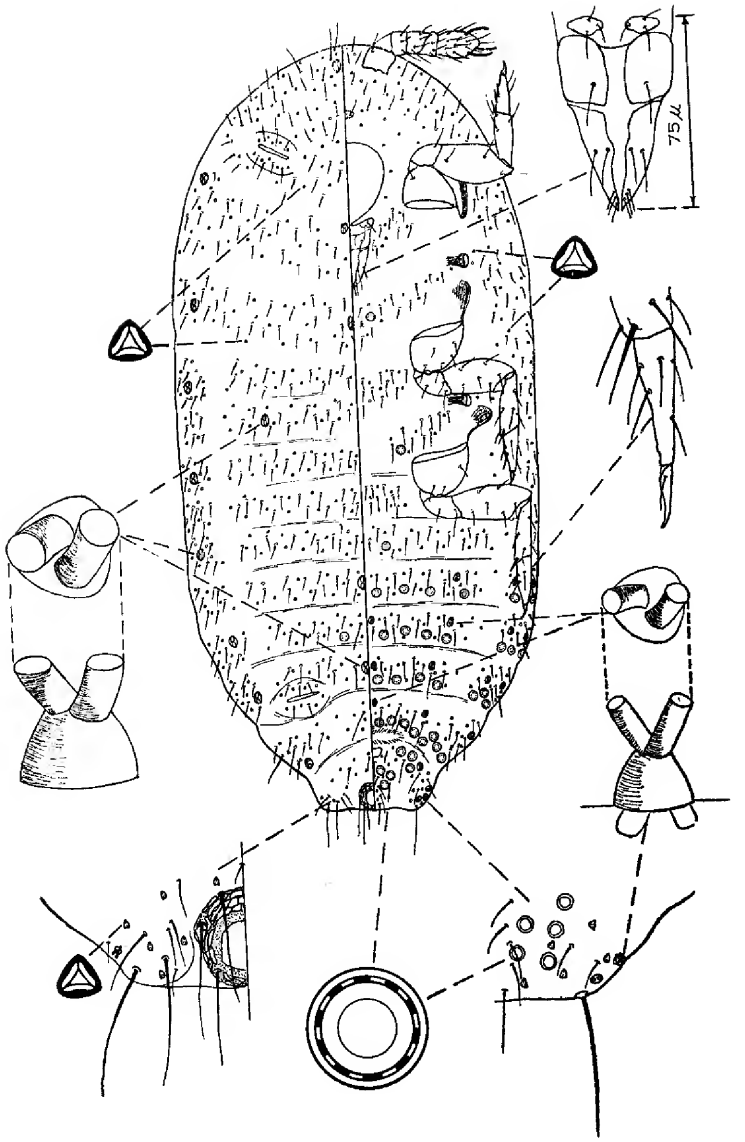

FIGURE 23.—*Rhizoecus carolinensis*, adult female, dorsal and ventral aspects and details.

Genus **Saccharicoccus** Ferris

Saccharicoccus Ferris, 1950, Atlas Scale Ins. North America **5**: 216.—Williams, 1962, Brit. Mus. (Nat. Hist.) Ent. Bull. **12** (1): 50.

Type of genus: *Dactylopius sacchari* Cockerell.

49. Saccharicoccus sacchari (Cockerell).

Dactylopius sacchari Cockerell, 1895, Trinidad Field Nat. Club, Jour. **2**: 195.

Pseudococcus sacchari: Fernald, 1903, Cat. Coccidae of World, 109.

Trionymus sacchari: Fullaway, 1923, Hawaiian Ent. Soc., Proc. **5**: 308.—Zimmerman, 1948, Insects of Hawaii **5**: 266.

Saccharicoccus sacchari: Ferris, 1950, Atlas Scale Ins. North America **5**: 217, fig. 81.—Beardsley, 1960, Hawaiian Ent. Soc., Proc. **17** (2): 236, fig. 4 (male).

DISTRIBUTION: Throughout tropical and subtropical regions of the world wherever sugar cane is cultivated.

S. MARIANA IS. SAIPAN: Garapan, April 1946, Krauss, on sugar cane; As Lito (Asilito), June 1946, Oakley, on sugar cane; Sept. 1956, McDaniel, on grass. TINIAN: Mt. Lasso, June 1946, Oakley, on sugar cane. ROTA: "Oscilita," June 1946, Oakley, rice. GUAM: Sept. 1937, Oakley, sugar cane; Yona, May 1936, Usinger, on sugar cane.

PALAU. BABELTHUAP: Ulimang, Dec. 1947, Dybas, on sugar cane. KOROR: July 1946, Oakley, on sugar cane; Mar. 1948, Maehler, on sugar cane; Jan. 1954, Beardsley, on stalks of tall grass.

YAP. YAP: Tomil, March 1949, Maehler, on *Saccharum officinarum*; Aug. 1950, Goss, on sugar cane.

CAROLINE ATOLLS. ULITHI: Mogmog I., Sept. 1956, McDaniel, on sugar cane. NUKUORO: Nukuoro I., Aug. 1946, Oakley, on sugar cane.

TRUK. FEFAN: May 1946, Townes, on *Sorghum vulgare*. TONOAS (Dublon): May 1946, Oakley, on sugar cane. TON (Tol): May 1946, Oakley, on sugar cane.

PONAPE. Experiment station (near Colonia), June 1950, Adams; Colonia, Aug. 1946, Oakley, on rice and on sugar cane; Colonia, Feb. 1948, Dybas, on sugar cane.

HOSTS: Sugar cane, sorghum, rice, and other large grasses.

Williams (1962) has called attention to the presence of many minute irregular pores on the ventral derm surrounding the attachment of the hind coxae of this species. Otherwise, the figures presented by Ferris (in Zimmerman, 1948, fig. 142; 1950, fig. 81) are adequate.

Genus **Trionymus** Berg

Trionymus Berg, 1899, Comun. Mus. Nac. Buenos Aires **1**: 78 (not seen).—Ferris, 1950, 1953, Atlas Scale Ins. of North America **5**: 251; **6**: 482.—McKenzie, 1960, Hilgardia **29** (15): 764.—Williams, 1962, Brit. Mus. (Nat. Hist.), Ent. Bull. **12** (1): 58.

Type of genus: *Westwoodia perisii* Signoret.

Trionymus, as defined by Ferris (1950, 1952), has been subject to some splitting in recent years (McKenzie, 1960; Williams, 1962). Much more study is necessary before the relationships between *Trionymus* and apparently related groups, such as *Chorizococcus* McKenzie and *Dysmicoccus* Ferris, will be understood satisfactorily.

Key to Known Micronesian Species of Trionymus

Bases of hind coxae apparently fused to body wall, the area of fusion forming an irregular sclerotized extension of the coxa beset with micropores; dorsal oral-collar ducts all of one size; ventral multilocular disc pores more numerous. . **palauensis**

Bases of hind coxae normal, not fused with body wall; oral-collar ducts of dorsum of two distinct sizes; multilocular disc pores less numerous. . . . . **townesi**

50. **Trionymus palauensis** Beardsley, n. sp. (figs. 24, 26, *d*, *e*).

Female. Size moderate, length of slide-mounted specimen about 2.6 mm.; body elongate; anal lobes hardly protuberant. Antennae 7-segmented, about 235 μ long. Legs short and slender; hind femora about 135 μ long; hind tibiae about 115 μ long. Hind coxae with proximal margins indistinct, apparently fused with body wall; area of fusion forming an irregular sclerotized patch (fig. 26, *d*), beset with numerous micropores mostly within the sclerotized patch, but also with a few in adjacent unsclerotized derm; these micropores forming a band completely around proximal margin of each coxa (fig. 26, *e*). A few micropores on ventral surface of coxa proper. Remaining segments of hind legs without micropores.

Two pairs of small dorsal ostioles present, their lips unsclerotized. Circulus absent. Eyes small, about 16 μ diameter, with a small ocular cone, without paraocular discoidal pores.

Cerarii limited to a single pair on anal lobes, each consisting of 2 conical setae 15–17 μ long plus 1 or 2 slender accessory setae; without an appreciable concentration of trilocular pores, the surrounding derm unsclerotized. Penultimate abdominal segment with a single conical or elongate stout seta on each lateral margin. Venter of anal lobe unsclerotized.

Tubular ducts of oral-collar type present on dorsum and venter; very small, about 1.5–2 μ diameter at orifice; distributed in a transverse row on dorsum of abdominal segments 4 to 9; and scattered along margins of venter on anterior abdominal segments, thorax, and head. Multilocular disc pores present on both dorsum and venter; fairly numerous on dorsum of abdominal segments 4 to 9, limited to a few on lateral margins of dorsum on anterior abdominal segments, thorax and head; very numerous on venter of posterior abdominal segments, moderately numerous laterally and mid-ventrally on anterior abdominal segments, thorax, and head. Trilocular pores moderately sparsely scattered on dorsum and venter. Body sparsely covered with fine setae; those of dorsum about 30 μ maximum length; those of venter about 40 μ maximum length; longer setae on anterior part of venter in front of mouthparts about 50 μ maximum length.

Holotype, female (BISHOP 6144), Koror, Palau Is., July 16, 1956, McDaniel.

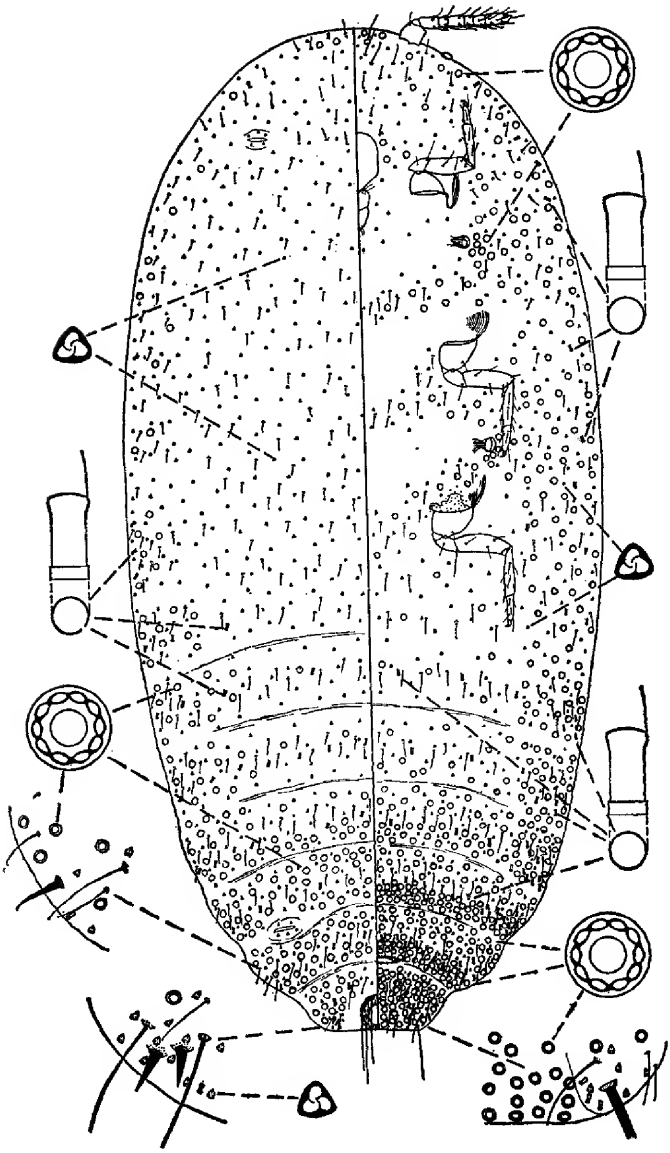

FIGURE 24.—*Trionymus palauensis*, adult female, dorsal and ventral aspects and details.

DISTRIBUTION: Caroline Is. (Palau).[5]

HOSTS: Unknown.

The unusual condition of the hind coxae is the most distinctive feature of this species. Otherwise, it resembles fairly closely *T. townesi*, described below. Additional features which may be used to separate *T. palauensis* from *T. townesi* are the presence of two distinct sizes of oral-collar tubular ducts and less numerous multilocular disc pores in the latter species.

51. Trionymus townesi Beardsley, n. sp. (figs. 25; 26, *c*).

Female. Size moderate, length of slide-mounted specimens about 2.6 mm.; body form elongate; anal lobes hardly protuberant. Antennae 7- or incompletely 8-segmented; around 260 μ long. Legs small, slender; hind femora about 125 μ long; hind tibiae about 115 μ long. Hind coxae (fig. 26, *c*) with numerous micropores both dorsally and ventrally in half adjacent to articulation with metapleural vestige; remaining segments and ventral derm surrounding articulation of hind coxae without discernible micropores. Rostrum small, about 84 μ long. Anal ring cellular, about 72 μ wide, bearing 6 setae about 100 μ maximum length. Eyes small, about 21 μ diameter; ocular cone very weakly developed; without paraocular micropores. Two pairs of dorsal ostioles present, their lips unsclerotized. Circulus absent.

Cerarii limited to single pair on anal lobes, each with 2 conical setae about 15 μ maximum length, 3 or 4 slender accessory setae, plus a very few trilocular pores around bases of setae; the surrounding derm unsclerotized. Venter of anal lobes unsclerotized; anal lobe seta about 130 μ long.

Oral-collar tubular ducts of two relatively distinct sizes, the larger about 4–5 μ diameter at orifice, the smaller about 2–2.5 μ diameter, present on dorsum and venter; larger type present in small numbers scattered on dorsum of head, thorax, and abdomen, limited to a few along margins of venter; smaller type present on dorsum in transverse rows near posterior margins of abdominal segments 3 to 8; and on venter in transverse bands near posterior margins of abdominal segments 6 and 7, a few along lateral margins of abdominal segments 5 to 9, a row on posterior margin of abdominal segment 8, a very few on segments 4 to 5. Oral-rim tubular ducts absent. Multilocular disc pores moderately numerous, scattered over entire surface on both dorsum and venter, slightly more numerous on posterior abdominal segments. Trilocular pores sparsely scattered over dorsum and venter. Body sparsely clothed with fine setae; those of dorsum about 27 μ maximum length; those of venter about 45 μ maximum length.

Holotype, female (US 67976), and 2 paratypes on one slide; S. Mariana Is., Tinian, Hagoya Lake, June 1946, Townes, on *Paspalum conjugatum*; 9 paratypes (BISHOP, US, UH) on 4 slides, same data as holotype.

DISTRIBUTION: S. Mariana Is. (Tinian).

HOST: *Paspalum conjugatum* (Hilo grass).

This species appears closely allied to *T. insularis* Ehrhorn, as defined by Ferris (*In* Zimmerman, 1948, **5**: 260, fig. 139). In Hawaiian specimens at hand which appear to be *insularis*, there are a few small oral-collar ducts discernible at least along the lateral margins of the abdomen (not indicated in Ferris' figure), but in *T. townesi*, oral-collar ducts are both more numerous and of two distinct sizes, with the larger size ducts particularly evident on the dorsum and along lateral margins of the venter.

[5] Since completion of this manuscript, a single specimen of what appears to be this species has come to hand from New Guinea, near Iroarere, Dec. 16, 1963, S. W. Brown, on grass.

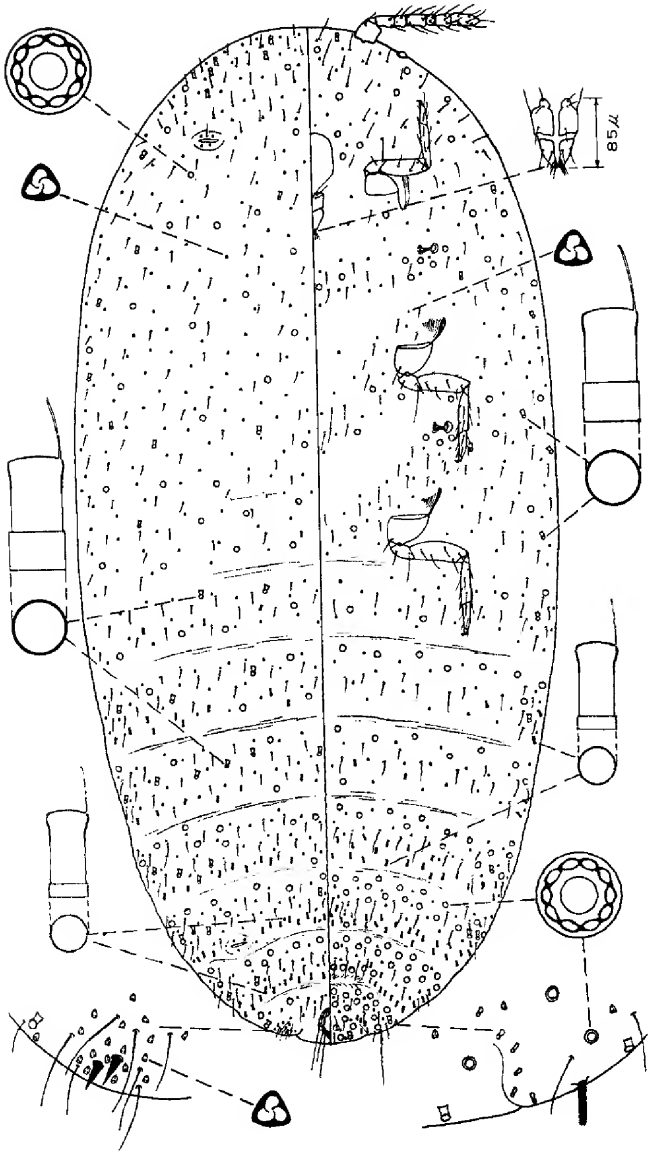

FIGURE 25.—*Trionymus townesi*, adult female, dorsal and ventral aspects and details.

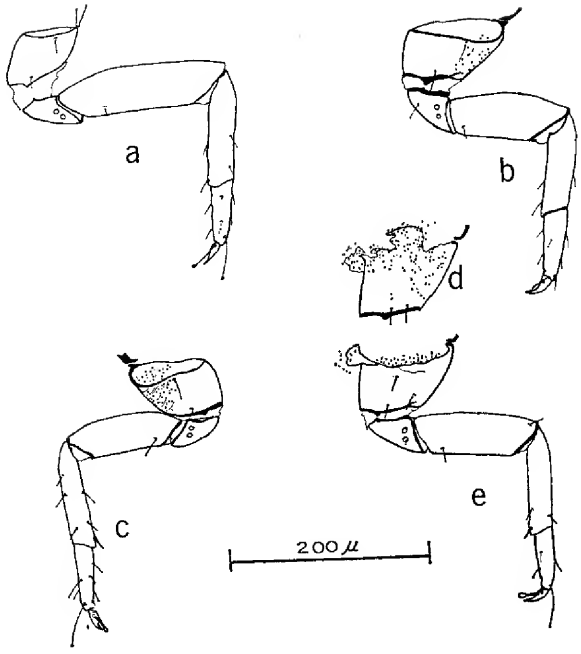

FIGURE 26.—Hind legs showing distribution of micropores: **a**, *Pandanicola pandani*, upper surface; **b**, *Palaucoccus gressitti*, upper surface; **c**, *Trionymus townesi*, upper surface; **d**, *T. palauensis*, lower surface, hind coxa; **e**, *T. palauensis*, upper surface.

Genus **Turbinococcus**, new genus

Recognition characters: Body form distinctly turbinate at maturity, anterior portion broadly rounded, posterior portion tapering to a relatively narrow apex; anal lobes not strongly developed. Antennae 6- or 7-segmented in the single known species; legs of normal form, moderately small, tarsal claws without a denticle on inner face, metacoxae with small translucent spots or micropores. Anal ring at posterior apex of dorsum, cellular, bearing 6 relatively elongate setae (about 3 times as long as anal ring in type species). Two pairs of dorsal ostioles present; circuli absent. Cerarii limited to one pair each on abdominal segments 8 and 9 in type species; each cerarius consisting of 2 well-developed conical setae, several slender accessory setae and a small concentration of trilocular pores. Small tubular ducts of oral-collar type present on venter; oral-rim tubular ducts absent; multilocular disc pores confined to venter; trilocular pores scattered over dorsum and venter; tritubular, bitubular, or discoidal pores, except for usual type of multilocular disc pores, wanting.

Type of genus: *Trionymus pandanicola* Takahashi.

This genus, as characterized by the single species here assigned to it, is rather similar to *Trionymus* except for the very distinctive form of the body. All species of *Trionymus* known to me are either rather narrow and elongate, or elongate-oval. It should be mentioned also that nearly all species assigned to *Trionymus*, as that genus has been defined by recent

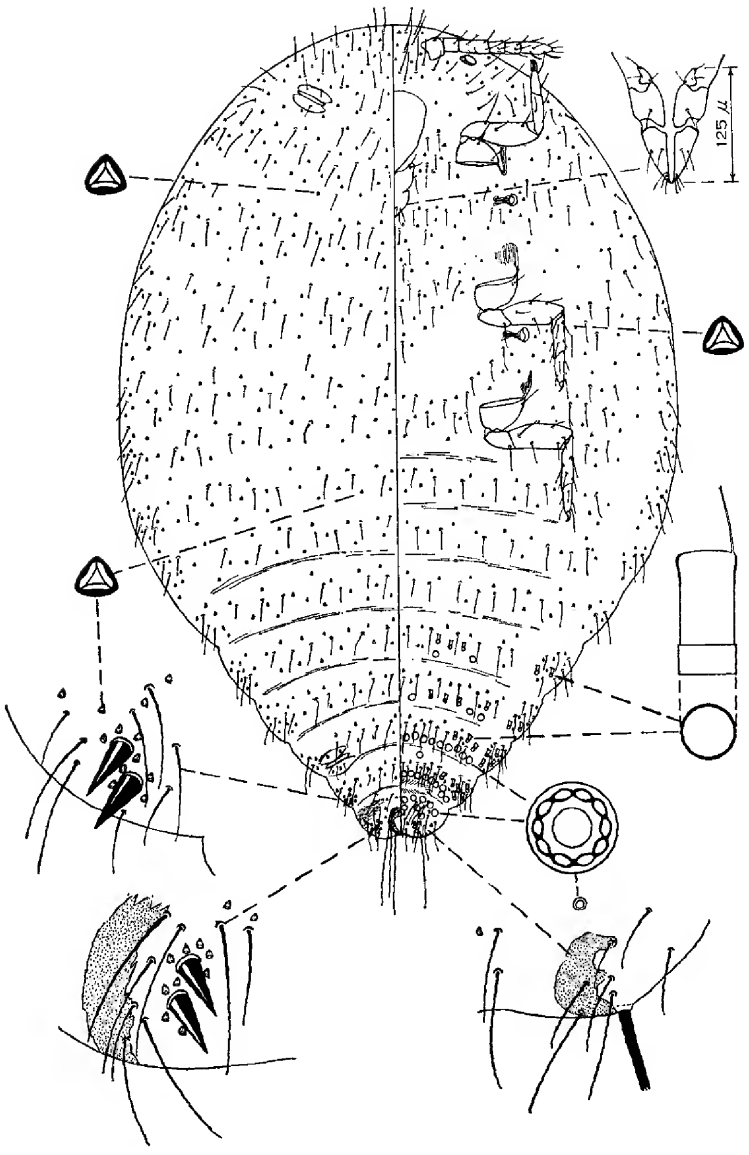

FIGURE 27.—*Turbinococcus pandanicola*, adult female, dorsal and ventral aspects and details.

workers (McKenzie, 1960 : 764; Williams, 1962 : 58), are attached to grasses, and most of the species remaining in *Trionymus* not found on grasses, such as *T. refertus* Ferris and *T. multiductus* Beardsley in Hawaii, probably should be assigned to other genera.

52. Turbinococcus pandanicola (Takahashi), new combination (fig. 27).

Trionymus pandanicola Takahashi, 1941, Tenthredo **3** (3) : 215, fig. 3.

DISTRIBUTION: Caroline Is. (Palau). Endemic?

PALAU. KOROR: Aug. 1937, Esaki, on *Pandanus* (ex type lot). NGURUKDABEL (Urukthapel): June 1958, Owen, on *Pandanus*.

HOST: *Pandanus* sp.

The derm surrounding the conical spines of the cerarii of this species is unsclerotized, although in recently collected specimens the dorsum of abdominal segment 9, anterior to each cerarius, appears somewhat sclerotized.

FAMILY COCCIDAE

The Coccidae or "soft scales" is a large group containing many species of economic importance. Most of the more important genera, such as *Coccus*, *Ceroplastes*, *Lecanium*, and *Pulvinaria*, are in need of thorough revisionary study. Of the 19 species here recorded, 18 are known from outside Micronesia and most of these are species of wide distribution. The one new species described here, *Paralecanium carolinensis*, belongs to a genus which has its greatest development in the Indo-Malayan region. This species may be endemic to Micronesia or may eventually be found in New Guinea, the Solomon Islands, or some other area adjacent to Micronesia when the coccid faunas of these areas have been more thoroughly investigated.

For a discussion of the morphological characters which have been found useful in the classification of the Coccidae see Steinweden (1929).

KEY TO GENERA OF COCCIDAE KNOWN FROM MICRONESIA

1. Margin of body with a continuous fringe of overlapping, broad fan-shaped setae ..... **Paralecanium**
   Margin of body without such a fringe of fan-shaped setae 2
2. Stigmatic depressions beset with numerous tuberclelike, peglike, or conical setae; mature female bearing a conspicuous wax test 3
   Stigmatic depressions normally with not more than 3 large elongate setae; mature female without such a conspicuous wax test 4
3. Cephalic end of body of mature female with a well-differentiated, thin, flattened, protruding anterior sclerotized lobe; wax test of mature female in form of a 7-pointed star ..... **Vinsonia**
   Cephalic end of body not so formed; wax test not stellate in form ..... **Ceroplastes**
4. Venter, at least of abdomen, with a broad sublateral band of tubular ducts on each side 5

Venter without sublateral bands of tubular ducts, occasionally with a few tubular ducts on mesal portion of venter of thorax 6

5. Adult female secreting an ovisac from ventral zone of tubular ducts; body remaining relatively flat at maturity, with dorsum only weakly sclerotized and not patterned with polygonal reticulations ..... **Pulvinaria**
Mature female not secreting an ovisac; body becoming strongly sclerotized at maturity, usually moderately to highly convex, concealing eggs and young beneath; dorsal derm with conspicuous reticulate pattern of polygonal areas ..... **Saissetia**

6. Mature female with dorsal derm strongly sclerotized and divided by membranous furrows into relatively large plates ..... **Eucalymnatus**
Mature female with dorsal derm not so formed ..... **Coccus**

Genus **Ceroplastes** Gray

Ceroplastes Gray, 1828, Spicilegia Zoologica, pt. **1**: 7, pl. 3, figs. 6–7 (not seen).—Steinweden, 1929, Ent. Soc. America, Ann. **22**: 231.

Type of genus: *Ceroplastes janeirensis* Gray.

Key to Species of Ceroplastes Reported From Micronesia

1. Marginal setae forming a continuous fringe around periphery of body, becoming enlarged and conical in form on margins of stigmatic depressions ..... **floridensis**
Marginal setae not forming a continuous peripheral fringe, largely restricted to stout setae of stigmatic depressions 2

2. Stigmatic clefts each with 50 to 100 bullet-shaped spines; apex of abdomen at maturity produced into a strongly sclerotized, roughly conical projection bearing anal plates at apex; wax test whitish, amorphous ..... **pseudoceriferus**
Stigmatic clefts each with around 30 or fewer conical, bullet-shaped, or knoblike setae; apex of abdomen frequently sclerotized at maturity, but not prolonged into a conical projection; wax test at maturity light pinkish to red 3

3. Stigmatic clefts each with 1 large conical seta 45–60 μ long, plus several smaller knoblike setae; legs small, around 120 μ total length; wax test largely pinkish or red in life, with transverse lines of white wax marking stigmatic furrows; not formed into a series of relatively flat plates ..... **rubens**
Largest conical seta of each stigmatic cleft about 20 μ long or less; legs relatively large, about 400 μ total length or more; wax test of mature female light pinkish in life, consisting of a dorsal plate and 6 peripheral plates, each with a dark central spot ..... **cirripediformis**

53. **Ceroplastes cirripediformis** Comstock.

Ceroplastes cirripediformis Comstock, 1881, U.S. Dept. Agric. Rept. for 1880, 333.

DISTRIBUTION: West Indies, Southern United States (type locality), Mexico, Hawaii, Marshall Is., Wake I. This species appears to be of Neotropical origin. It was first discovered in Hawaii in 1952, and appears to have spread into the Marshall Islands within the past few years.

WAKE. Nov. 1959, Ford, on *Ceodes* or *Pisonia*; Nov. 1962, Joyce. WILKES: Feb. 1963, Clagg, on *Ipomoea*.

MARSHALL IS. ENIWETOK: Medren I., Sept. 1957, Tuthill, on *Pseuderanthemum*. KWAJALEIN: Kwajalein I., June 1958, Owen, on *Coccolobis* leaves.

HOSTS: *Coccolobis*, *Ipomoea*, *Pseuderanthemum*, etc. In Florida, Merrill (1953 : 86) records this species from avocado, citrus, guava, litchi, and a number of other hosts.

Ceroplastes cistudiformis Cockerell, 1893 [Zoe 4 (1) : 105], a name under which this species has been recorded several times in Hawaii, is very likely a synonym of *C. cirripediformis*. About the only possible differences which can be deduced from the original descriptions of these two are in reference to over-all size. The largest specimens of the type lot of *C. cistudiformis* is stated to be 7.5 mm. long, 6 mm. wide, and 4.5 mm. high; whereas the average size of specimens from the type lot of *cirripediformis* was said to be 5 mm. long, 4 mm. wide, and 4 mm. high. Since the Hawaiian specimens which I have examined vary considerably in their dimensions depending upon the host, the degree of crowding, etc., size alone does not appear to be a useful criterion for separating species in this group. No type material of either *C. cirripediformis* or *C. cistudiformis* has been available for study, and therefore I have chosen to apply the older name to the Hawaiian and Micronesian specimens at hand.

54. Ceroplastes floridensis Comstock.

Ceroplastes floridensis Comstock, 1881, Rept. U.S. Dept. Agric. for 1880, 331.—Ferris, 1950, Microent. **15** (3) : 75, fig. 41.

DISTRIBUTION: Widespread (type locality: Florida).

BONIN IS. Kuwana (1909 : 159) lists this species from the Bonin Islands, no specific locality.

S. MARIANA IS. ROTA: Takahashi (1936) reports this species from Rota on *Cycas*. GUAM: Fullaway (1946 : 159) records this species on mango.

PALAU. KOROR: Takahashi (1939 : 263) records it from *Artocarpus integer*. ULEBSEHEL (Auluptagel): July 1956, McDaniel. PELELIU: Aug. 1945, Dorsey.

HOSTS: Recorded only from *Artocarpus integer* (= *A. heterophyllus*), *Cycas*, and mango in Micronesia. Merrill (1953 : 88) gives a long list of hosts for Florida, including avocado, *Citrus* spp., *Ficus* spp., *Gardenia*, *Hibiscus*, litchi, and others which are common in Micronesia.

55. Ceroplastes pseudoceriferus Green.

Ceroplastes pseudoceriferus Green, 1935, Stylops **4** (8) : 180, fig. 1.—Sankaran, 1962, Indian Jour. Ent. **24** (1) : 1–18, pls. 1–8.

DISTRIBUTION: Japan, India, Ceylon (type locality not specified), Caroline Is. (Palau).

PALAU. ULEBSEHEL (Auluptagel): July 1956, McDaniel, on unidentified vine.

HOSTS: No specifically identified host known for Micronesia. Green (1935) recorded the species from a Japanese maple imported from Japan, and from *Azadirachta indica* and *Diospyros montana* from India.

56. Ceroplastes rubens Maskell.

Ceroplastes rubens Maskell, 1892, New Zealand Inst., Trans. **25**: 214.—Zimmerman, 1948, Insects of Hawaii **5**: 343.

DISTRIBUTION: Widespread (type locality: Brisbane, Australia).

S. MARIANA IS. SAIPAN: Near Tanapag Harbor, July 1946, Townes; U.S.C.C. Farm, June 1946, Oakley, on mango leaves; Magicienne Bay, Feb. 1949, Maehler, on *Barringtonia*. ROTA: Sonson, June 1946, Oakley, on *Cycas*. GUAM: Jan. 1938, Oakley, on sunflower; s. e. coast, May 1945, G. Bohart; Mt. Santa Rosa, May 1945, Bohart and Gressitt; northern Guam, Apr. 1946, Krauss, on *Cycas* sp.; Umatac, Feb. 1948, Maehler, on *Ficus*; Sept. 1953, Liming, on *Calophyllum*.

PALAU. NGAIANGL (Kayangel): July 1956, McDaniel, on coconut. KOROR: July 1953, Beardsley, on mango leaf.

HOSTS: Coconut, mango, and various ornamental and uncultivated plants. Takahashi (1936, 1939) recorded this species from Rota and Palau, on *Cycas* and *Artocarpus integer*.

Genus **Coccus** Linnaeus

Coccus Linnaeus, 1758, Syst. Nat., 10th ed., 455.—Steinweden 1929, Ent. Soc. America, Ann. **12**: 222.

Type of genus: *Coccus hesperidum* L.

KEY TO KNOWN MICRONESIAN SPECIES OF COCCUS
(In part after Zimmerman, 1948)

1. Anal plates elongate, anterolateral margin of each at least twice as long as posterolateral margin 2
   Anal plates not conspicuously elongate, the two plates together approximately quadrangular in form, posterolateral margin of each plate usually slightly longer than anterolateral margin 3
2. Legs relatively small, hind femora around 135–140 μ long, meso- and metacoxae only slightly larger than procoxae, of normal form ..... **mangiferae**
   Legs larger, hind femora around 300 μ long, meso- and metacoxae much larger than procoxae, relatively much broader basally ..... **acuminatus**

3. A relatively elongate species, normally nearly twice as long as maximum width; anal plates each with a discal seta situated in front of usual 3 setae of posterior apex of dorsum, at a distance equal to about one-fifth total length of plate; normally with 3 or 4 long setae ("fringe setae") on each side of transverse anterior margin of anal pocket beneath anal plates..... **elongatus**
   Normally less elongate species, about 1.5 times as long as maximum width or less; anal plates without discal setae; normally with 2 such "fringe setae"..... 4
4. Dorsum with a reticulum of intersecting rows or bands of very small circular pores; dorsal setae relatively thick, blunt, slightly clavate; a sparse series of tubular ducts extending submarginally completely around periphery of dorsum, about 15 ducts on each side of body (fig. 26)..... **moestus**
   Dorsum without such a reticulum of small circular pores, pores present but more or less uniformly distributed; dorsal body setae filamentous or slightly thickened, not noticeably clavate; without a submarginal dorsal series of tubular ducts..... 5
5. Marginal setae small, short, broadly and strongly fimbriate apically; living adult female bright green in color..... **viridis**
   Marginal setae relatively elongate, entire, or but slightly cleft or fimbriate apically; mature female brownish..... **hesperidum**

57. Coccus acuminatus (Signoret).

Lecanium acuminatum Signoret, 1873, Soc. Ent. France, Ann. V, **3** : 397.
Coccus acuminatus: Kirkaldy, 1902, Fauna Hawaiiensis **3** (2) : 105.—Zimmerman, 1948, Insects of Hawaii **5** : 294, fig. 154.
Protopulvinaria acuminata: Steinweden, 1929, Ent. Soc. America, Ann. **22** : 223.

DISTRIBUTION: Widespread (type locality: Ceylon).

S. MARIANA IS. GUAM: 1936, Swezey; Orote Point, Nov. 1937, Oakley, on *Ochrosia* sp.; Aug. 1938, Oakley, on *Gardenia*.

PALAU. KOROR: July 1953, Beardsley, on *Premna* leaves; Apr. 1954, Beardsley, on *Glochidion* and *Nephrolepis* fern. NGERKABESANG: Aug. 1953, Beardsley, on guava leaves.

HOSTS: In addition to the hosts cited above for Micronesia, this species infests citrus and mango in Hawaii, and is recorded from a long list of host plants in Florida by Merrill (1953 : 89). Takahashi (1936, 1939) recorded this species from Rota and Palau on mango.

58. Coccus elongatus (Signoret).

Lecanium elongatum Signoret, 1873, Soc. Ent. France, Ann. V, **3** : 404.
Lecanium frontale Green, 1904, Coccidae of Ceylon **3** : 192, pl. 65.—Kuwana, 1909, New York Ent. Soc., Jour. **17** : 159.
Coccus elongatus: Sanders, 1909, Jour. Econ. Ent. **2** (6) : 438.—Zimmerman, 1948, Insects of Hawaii **5** : 300, fig. 156.
Lecanium (*Coccus*) *celtium* Kuwana, 1909, New York Ent. Soc., Jour. **17** : 162.

DISTRIBUTION: Widespread (type locality: France).

BONIN IS. No exact locality, no date, Kuwana. Kuwana's *Lecanium*

celtium, described from the Bonin Islands, has been reduced to a synonym of *C. elongatus* by Takahashi (1955 : 69). Takahashi further states (ibid., p. 69) that specimens from the Bonin Islands identified as *Lecanium hesperidum* by Kuwana (1909 : 159) are in fact *C. elongatus*.

S. MARIANA IS. SAIPAN: Native village, June 1946, Oakley, on *Ficus*; near Marpi Point, June 1946, Townes, on *Abrus precatorius*. TINIAN: Mt. Lasso, June 1946, Oakley, on cotton. GUAM: Sept. 1937, Oakley, on *Pithecellobium dulce*; Feb. 1938, Oakley, on croton; Marine barracks, Nov. 1938, Oakley, on *Hibiscus*; Libugon Farm, July 1939, Oakley, on *Botor tetragonoloba*; 1.6 km. south-east of Asan, Nov. 1947, Dybas, on "tree with peltate leaf"; Dec. 1953, Liming, on *Leucaena glauca*.

PALAU. BABELTHUAP: Near Ngarard landing, July 1953, Beardsley, on mangrove tree; Ngiwal, Apr. 1953, Beardsley, on unidentified shrub. KOROR: Aug.–Sept. 1953, Beardsley, on coconut, rose leaves, and on soursop leaves. NGURUKDABEL: Aug. 1953, Beardsley, on unidentified tree.

CAROLINE ATOLLS. FARAULEP: Faraulep I., Jan. 1964, Owen, on soursop leaves.

MARSHALL IS. KWAJALEIN: Kwajalein I., June 1958, Owen, on *Casuarina*. MAJURO: Darrit I., June 1958, Owen, on *Hibiscus* stems; Uliga I., June 1958, Owen, on *Codiaeum* leaves.

GILBERT IS. TARAWA: Williams (personal communication) reports having seen specimens on *Ficus* sp. from Tarawa.

HOSTS: Micronesian records are from *Annona* spp., citrus, coconut, papaya, and various ornamental and uncultivated plants. Takahashi (1936–1942) reports this species from Saipan, Rota, and the Palau Islands, on *Annona muricata*, *A. squamosa*, avocado, citrus, papaya, and *Terminalia*.

59. Coccus hesperidum Linnaeus.

Coccus hesperidum Linnaeus, 1758, Syst. Nat., ed. 10, 455.—Zimmerman, 1948, Insects of Hawaii **5** : 301, fig. 157.

DISTRIBUTION: Widespread (type locality: Europe?).

S. MARIANA IS. SAIPAN: June 1946, Townes, on papaya.

PALAU. KOROR: June 1958, Owen, on coconut leaves. PELELIU: July 1946, Oakley, on *Cocos nucifera*.

YAP. YAP: In quarantine at Honolulu, Feb. 1952, Makino, on birds nest fern.

CAROLINE ATOLLS. NUKUORO: Nukuoro I., Aug. 1946, Oakley, on *Cyrtosperma*, *Citrus*, and papaya, Aug. 1946, Townes, on *Cyrtosperma chamissonis*, *Plumeria acuminata*, and *Premna*; Shenukdei I., Aug. 1946, Townes, on *Thespesia populnea*.

TRUK. TONOAS (Toloas-Erin): Takahashi (1952) records *C. hesperidum* from this locality on *Citrus*.

MARSHALL IS. ENIWETOK: Jobtan (Japtan) I., May 1946, Townes, on *Pisonia grandis*; Enjebi I., May 1946, Oakley, on *Pisonia grandis*. UJELANG: Ujelang I., Oct. 1953, Beardsley, on breadfruit leaf. WOTHO: Oct. 1953, Beardsley, on *Allophylus* and *Morinda citrifolia*. RONGELAP: Rongelap I., Oct. 1953, Beardsley, on breadfruit leaves and *Morinda citrifolia*. KWAJALEIN: Aug. 1946, Oakley, on coconut and *Morinda citrifolia*; Kwajalein I., June 1958, Owen, on leaves of unknown shrub. NAMU: Majkou I., Oct. 1953, Beardsley, on *Allophylus*. MAJURO: Majuro I., Aug. 1946, Oakley, on banana and lime, May 1958, Owen, on coconut leaves.

HOSTS: Banana, breadfruit, citrus, coconut, *Cyrtosperma* (giant taro), and various ornamental and uncultivated plants have been reported as hosts in Micronesia.

60. Coccus mangiferae (Green).

Lecanium mangiferae Green, 1889, Ent. Mo. Mag. **25** : 249, figs. 1–4.

Coccus mangiferae: Fernald, 1903, Cat. Coccidae of World, 172.—Zimmerman, 1948, Insects of Hawaii **5** : 306, fig. 159.

DISTRIBUTION: Widespread (type locality: Ceylon).

PALAU. BABELTHUAP: Cacao Project near Imeliik, Aug. 1953, Beardsley, on leaf of unidentified tree. KOROR: Sept. 1952, Krauss, on mango leaf.

HOSTS: Mango, and several other hosts. Merrill (1953 : 92) records this species from a number of hosts including orange and such common ornamentals as *Eugenia*, *Ixora*, and *Lantana*.

61. Coccus moestus De Lotto (fig. 28).

Coccus moestus De Lotto, 1959, Ent. Soc. So. Africa, Jour. **22** (1) : 164, fig. 165.

DISTRIBUTION: Africa (type locality: Kenya), Zanzibar, S. Mariana Is., Caroline Is.

S. MARIANA IS. GUAM: 1, Mt. Alifan, Apr. 1946, Krauss, on mango.

PALAU. BABELTHUAP: 1, Ulimang, Dec. 1947, Dybas, on breadfruit. KOROR: Jan. 1954, Beardsley, on *Scaevola*. PELELIU: July 1946, Oakley, on *Artocarpus altilis*.

CAROLINE ATOLLS. WOLEAI: Utegal I., Jan. 1964, Owen, on breadfruit leaves.

TRUK. WENA (Moen): Civil Administration Area, Mar. 1949, Potts, on breadfruit; Feb. 1954, Beardsley, on breadfruit leaves.

This species heretofore has been known only from Africa (Kenya) and Zanzibar. The accompanying figure, based on a specimen from Truk, was prepared before De Lotto's description became available. Micronesian specimens have since been compared with De Lotto's type slide in the

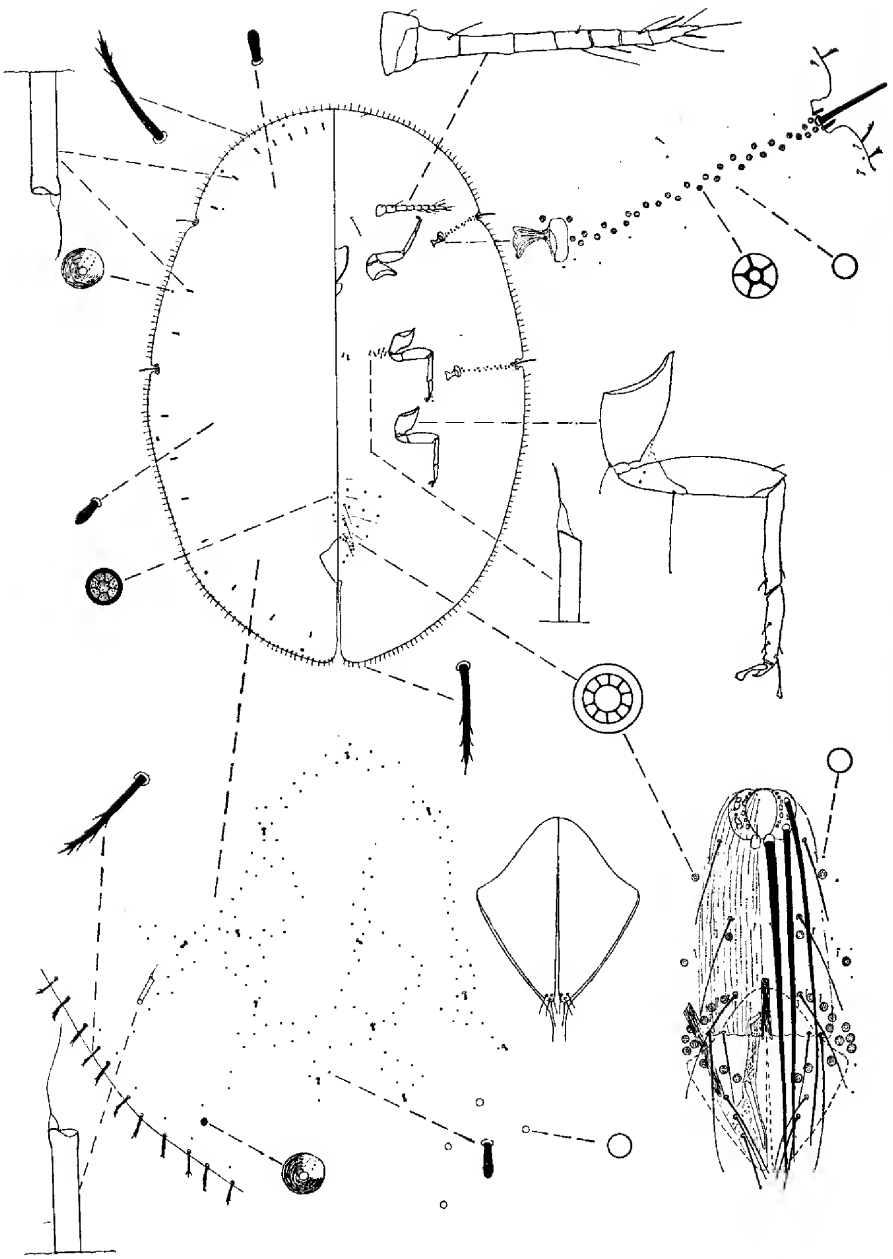

FIGURE 28.—*Coccus moestus*, adult female, dorsal and ventral aspects and details.

British Museum by Dr. D. J. Williams, who has confirmed my determination.

No information is available concerning the appearance of living scales other than they are apparently quite flat on leaves. However, in preparing specimens preserved in alcohol it was noted that a thin transparent layer of wax, which covered the dorsum, was dislodged in fairly definite small polygonal patches. Possibly this may reflect the reticulate arrangement of the minute circular pores on the dorsum.

62. Coccus viridis (Green).

Lecanium viride Green, 1889, Ent. Mo. Mag. **25**: 248.

Coccus viridis: Fernald, 1903, Cat. Coccidae of World, 174.—Zimmerman, 1948, Insects of Hawaii **5**: 311, fig. 161.

DISTRIBUTION: Widespread (type locality: Ceylon).

S. MARIANA IS. SAIPAN: Chalan Laulau, Aug. 1946, Oakley, on coffee and *Psychotria marianensis*; Susupe, Jan. 1948, Maehler, on unidentified flower; Tanapag, Jan. 1949, Maehler, on coffee. TINIAN: Mt. Lasso, June 1946, Oakley, on *Psychotria marianensis*; Mt. Lasso, June 1946, Townes, on *Canthium*. GUAM: Sept. 1953, Liming, on *Randia* sp.; Oct. 1953, Liming, on *Plumeria*; Jan. 1954, Liming, on *Gardenia jasminoides* and *Limnophila* sp.

PALAU. BABELTHUAP: July 1946, Townes, on *Mussaenda sericea*. KOROR: July 1946, Oakley, on *Mussaenda*; Dec. 1952, Gressitt, on *Gardenia*; Feb. 1953, Beardsley, on *Gardenia*, citrus, and *Plumeria*.

YAP. YAP: Kolonia (Yaptown), July 1946, Townes, on *Timonias alba* (?): Apr. 1950, Langford, on citrus leaves; Oct. 1952, Krauss, on citrus.

TRUK. WENA (Moen): Oct. 1952, Beardsley, on *Gardenia*. TON (Tol): May 1946, Townes, on *Randia carolinensis*.

PONAPE. Experiment Station near Colonia, Aug. 1946, Oakley; Colonia, Jan. 1947, Ross, on *Citrus aurantium*; Colonia, Feb. 1948, Dybas, on frangipani leaf (*Plumeria*).

OCEAN I. (Banaba): Dec. 1957, Krauss, on leaf of *Ixora*.

HOSTS: Recorded from citrus, coffee, *Gardenia*, *Plumeria*, soursop, and several other ornamental and wild hosts in Micronesia. Takahashi (1936–1942) records *C. viridis* from Saipan, Yap, and Palau, from *Annona muricata*, citrus, *Ixora*, *Musa*, *Piper* (?), and *Plumeria*.

An entomogenous fungus, *Verticillium* (= *Cephalosporium*) *lecanii* (Zimmerman), was found destroying infestations of this scale at Koror in 1953.

Genus **Eucalymnatus** Cockerell

Eucalymnatus Cockerell, 1901, Canad. Ent. **33**: 57.

Type of genus: *Lecanium tessellatum* Signoret.

This genus was established to accomodate the type species, *L. tessellatum*,

the widespread tessellated scale. Steinweden (1929 : 224) states that young adult individuals before hardening and tessellating of the derm are similar to species assigned to *Coccus*, and that he does not feel *Eucalymnatus* should be maintained as distinct from *Coccus*, or at most it should be given no more than subgeneric rank. However, the majority of authors have continued to recognize *Eucalymnatus*.

63. Eucalymnatus tessellatus (Signoret).

Lecanium tessellatum Signoret, 1873, Soc. Ent. France, Ann. V, **3** : 401.
Lecanium (*Eucalymnatus*) *tessellatus:* Cockerell, 1901, Canad. Ent. **33** : 57.
Coccus tessellatus: Kirkaldy, 1902, Fauna Hawaiiensis **3** (2) : 106.
Eucalymnatus tessellatus: Cockerell, 1902, Ann. Mag. Nat. Hist. VII, **9** :453.—Zimmerman, 1948, Insects of Hawaii **5** : 318, fig. 163.

DISTRIBUTION: Widespread (type locality: France).

PALAU. BABELTHUAP: Airai, July 1953, Beardsley, on soursop. KOROR: Aug. 1953, Beardsley, on coconut.

TRUK. WENA (Moen): May 1946, Townes, on *Sonneratia casseolaris.*

PONAPE. Madolenihm Plantation, Nov. 1953, Beardsley, on coconut.

KUSAIE. Lele, Aug. 1946, Oakley, on *Calophyllum indicum*; Malem, Feb. 1953, Clarke, on *Nipa fruticans* and *Cocos nucifera*; Lele, Feb. 1953, Clarke, on *Nipa fruticans.*

HOSTS: Coffee, coconut, mango, *Nipa* palm, *Calophyllum*, *Sonneratia*, and soursop recorded in Micronesia. In Florida, Merrill (1953) has recorded this species from a long list of hosts including avocado, banana, mango, and a number of ornamentals which are also common in Micronesia.

Takahashi (1939–1942) records *E. tessellatus* from Saipan, Truk, and Kusaie, on *Arenga pinnata*, coffee, *Gardenia*, and mango.

Genus **Paralecanium** Cockerell

Paralecanium Cockerell, 1899, The Industrialist, 227 (not seen).—Morrison, 1922, U.S. Nat. Mus., Proc. **60** : 78, fig. 26.

Type of genus: *Lecanium frenchii* Maskell.

64. Paralecanium carolinensis Beardsley, n. sp. (fig. 29).

Female. Broadly oval; mature specimens about 3 mm. long by about 2.5 mm. maximum width; flat, closely appressed to surface of host leaf; dorsum strongly sclerotized at full maturity, young adults largely unsclerotized except for anal plates. Anal cleft behind anal plates about 2.5 times length of anal plates. Dorsum of mature individuals with a marginal zone of 20 to 22 narrow, nearly straight to slightly sinuate, elongate membranous areas on each side, which extend inward at right angles from margin, 0.25 to 0.4 of distance from margin to center of dorsum; remainder of dorsal derm marked by an irregular, often poorly defined pattern of small areas of heavy and lighter sclerotization, sometimes appearing vaguely reticulate. Posterior portion of dorsum with four conspicuous groups of compound

pores, appearing as small areolations, in a submarginal row on each side, these situated approximately on the mesal margin of the marginal band of narrow membranous areas. Dorsal unsclerotized eye spots of head well defined, around 30 μ diameter. Ventral derm unsclerotized, except for a narrow marginal zone of weak to moderately heavy sclerotization in some specimens.

Appendages small; antenna 6-segmented, around 190 μ long; segments 3 and 6 longest, subequal, each about 48 μ in length. Legs all approximately equal in size and shape, each about 170 μ total length; trochanters apparently fused with coxae; tarsi apparently fused with tibiae. Anal plates elongate, with lateral margins rounded, outer angle not acute; each plate about 125–130 μ long by about 48–50 μ maximum width; with a small discal seta located anterior to apex a distance equal to about 0.25 length of plate; 2 additional small setae on margin of each plate near apex. Fringe setae beneath anal plates very short and fine, 6–8 μ long, 2 or 3 on each side; 1 or 2 minute ventral setae on ventral sclerotized process of each plate. Anal ring small, cellular, bearing 3 large ring setae, longer than anal plates and somewhat thickened basally, on each side. Length of invaginated anal tube approximately equal to that of anal plates.

Marginal flabellate setae very broad, mostly 35–45 μ wide by about 18 μ maximum length, the outer edges very faintly serrate, the disc of the fan usually with discernible ridges radiating from near base to outer margin. Flabellae slightly overlapping laterally, forming a nearly continuous peripheral fringe. Marginal stigmatic clefts well defined, of moderate depth, each with 9 to 20 well-developed clavate setae mostly 12–25 μ long, and sometimes slightly acute at apex, in a compact transverse band extending a short distance mesad from inner margin of cleft. Dorsum with small, slightly spiniform setae, about 14 μ long, sparsely scattered over surface. Marginal areas of venter with a sparse scattering of very fine setae about 9 μ maximum length, these noticeably more concentrated on either side of anal cleft near posterior apex of body. Midventral setae in area cephalad of vulva and behind rostrum noticeably longer, arranged in transverse rows of 4 to 8 setae on each segment, mostly 25–40 μ long; a single submedian seta about 90 μ long on each side immediately anterior to presumed location of indiscernible vulva. Dorsal derm with sparsely scattered small tubular ducts with oval orifices about 2 μ wide by about 3 μ long; the lumen of each duct apparently divided into two cells by a transverse sinuate septum. Additional small circular stellate pores about 3 μ diameter sparsely scattered on dorsum. Compound pore groups on posterior part of dorsum each with 5 to 8 somewhat irregularly shaped granular spots; individual spots of various sizes, usually 6–20 μ at widest point, the larger spots divided by transverse or radial septa into 2 to 7 cells; each spot surrounded by a membranous ring in fully sclerotized individuals; these in turn sometimes surrounded by rings of slightly heavier sclerotization than surrounding derm. Venter with fairly numerous multilocular disc pores about 7 μ diameter in vulvar area, around 20 to 27 pores in a band on each side of vulva, a similar number on each side of each of the 2 prevulvar abdominal segments. Stigmatic furrows each with a band of around 23 to 33 stellate pores about 5 μ diameter extending from spiracles to margin of stigmatic cleft on posterior margin of group of clavate setae. Tubular ducts not discernible on venter.

Holotype, mature female (BISHOP 6145) and 1 paratype (young unsclerotized adult) on one slide; Caroline Atolls, Losap, Losap I., Oct. 31, 1952, Beardsley, on *Pandanus* sp. leaves. Four paratypes (US, UH) on two slides, same data as type. The following additional specimens are also designated as paratypes: Caroline Atolls, Nomwin, Nomwin I., Feb. 1954, Beardsley, on *Pandanus* leaves (3 slides). Truk. Ton (Tol), Mt. Unibot, at summit, Dec. 1952, Gressitt, on *Freycinetia* (1 slide).

DISTRIBUTION: Caroline Is. (Losap, Nomwin, Truk). That this species is perhaps endemic to Truk is indicated by its occurrence there and on nearby atolls only, although one of its hosts, *Pandanus*, is common and widespread throughout Micronesia and elsewhere in the Pacific.

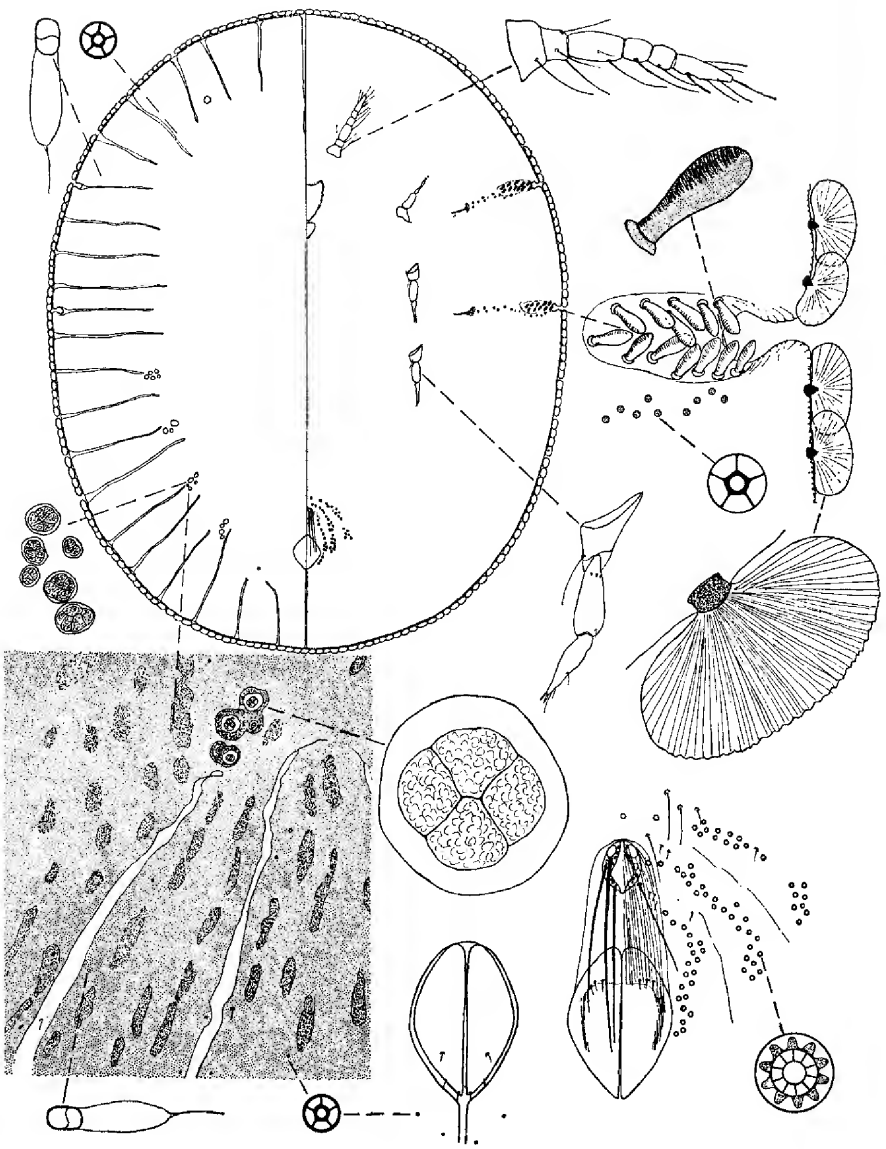

FIGURE 29.—*Paralecanium carolinensis*, adult female, dorsal and ventral aspects and details.

Paralecanium carolinensis differs from all other known species of the genus in the relatively numerous clavate setae associated with the stigmatic clefts. In other species known to me these setae, in addition to being less numerous (usually 3 or 4, but sometimes as many as 6 or 7), are generally much more elongate and not conspicuously clavate.

Genus **Pulvinaria** Targioni-Tozzetti

Pulvinaria Targioni-Tozzetti, 1867, Soc. Ital. Sci. Nat. Mem. **3** (3) : 13.—Steinweden, 1929, Ent. Soc. America, Ann. **22** : 226.

Type of genus: *Coccus vitis* Linnaeus.

This important and inadequately known group of soft scales is represented by three species in the Micronesian material available for study. A fourth species, *P. aurantii* Cockerell, is listed by Kuwana from the Bonin Islands.

Papers by Steinweden (1946) and Takahashi (1955, 1956) have been helpful in dealing with species of this genus.

Key to Species of Pulvinaria Reported From Micronesia

1. With at least some of the marginal setae slightly to conspicuously expanded and bifid or fimbriate apically 2
   Marginal setae all cylindrical, slightly narrower at apex than at base, the apex with a small V-shaped incision ..... **thespesiae** (?)
2. With a dorsal submarginal series of 5 to 9 small sclerotized gland tubercles on each side; ovisac relatively short and broadened posteriorly 3
   With not more than 1 or 2 dorsal submarginal gland tubercles on each side; ovisac relatively narrow and elongate, not appreciably broadened posteriorly .... **urbicola**
3. Marginal setae relatively short and broad, all broadly fimbriate at apex ..... **psidii**
   Marginal setae relatively long and narrow, blunt, bifid, or slightly fimbriate at apex ..... **aurantii**

65. **Pulvinaria aurantii** Cockerell.

Pulvinaria aurantii Cockerell, 1896, U.S. Dept. Agric. Ent. Div. Tech. Bull. **4** : 48.—Kuwana, 1909, New York Ent. Soc., Jour. **17** : 159.—Takahashi, 1955, Kontyu **23** (4) : 150.

DISTRIBUTION: Japan (type locality), Bonin Islands (?).

BONIN IS.: Kuwana reported collecting this species on citrus in the Bonin Islands (no exact locality specified). No Micronesian specimens have been available, and it has been included in the key solely on the basis of Takahashi's redescription (1955) and a single imperfect specimen from Japan, in quarantine at San Francisco, which is in the U.S. National Coccid collection.

66. Pulvinaria psidii Maskell.

Pulvinaria psidii Maskell, 1892, New Zealand Inst., Trans. **25**: 223.— Zimmerman, 1948, Insects of Hawaii **5**: 336, fig. 172.

DISTRIBUTION: Widespread (type locality: Hawaii).

BONIN IS.: No locality or date, Kuwana, collector.

VOLCANO IS. Iwo JIMA: July 1958, Owen, on leaves of *Morinda* and *Trema*.

S. MARIANA IS. GUAM: Dededo, July 1939, Oakley, on coffee; Talofofo, June 1946, Townes, on *Morinda citrifolia*; Mt. Lamlam, Feb. 1958, Krauss, on *Melastoma marianum* leaves.

PALAU. BABELTHUAP: Ulimang, Dec. 1947, Dybas. KOROR: Limestone ridge north of inlet, June 1948, Dybas; Jan. 1954, Beardsley, on *Plumeria* leaves and *Scaevola*.

TRUK. WENA (Moen): Feb. 1953, Gressitt, in *Morinda* bracts on stem. FEFAN: May, 1946, Townes, on *Jussiaea*.

PONAPE. Colonia, July 1949, Owen, on oleander leaves and *Psidium* sp. leaves, stem, and fruit; Lengar (Langar) I., Aug. 1950, Adams.

KUSAIE. Lele, Aug. 1946, Oakley, on *Plumeria*, and *Ficus*.

MARSHALL IS. JALUIT: Jabor I., Aug. 1946, Oakley, on *Morinda citrifolia*.

HOSTS: Reported from a wide range of broadleaf plants. In Micronesia, common on guava, *Morinda*, *Plumeria* and others. Takahashi (1936–1942) records *P. psidii* from Saipan, Palau, Truk, Ponape, and Kusaie, on coffee, *Melastoma*, *Morinda citrifolia*, *Psidium guajava*, and *Plumeria*.

Ferris has stressed the presence of a crescentic sclerotized area surrounding the spiracles as a useful diagnostic character. Although these areas are often quite well defined in older adult females with well-developed ovisacs, they are frequently poorly indicated or entirely wanting in young adults. At the suggestion of Dr. Morrison, I examined a number of specimens of various ages from an infestation on *Schinus terebinthifolius* collected near Honolulu, Hawaii. Of these specimens, those with well-developed ovisacs all showed well-developed perispiracular sclerotized areas, whereas specimens without ovisacs had these sclerotic areas variously developed, or often wanting.

67. Pulvinaria thespesiae Green (?).

Pulvinaria thespesiae Green, 1909, Coccidae of Ceylon **5**: 259, pl. 97.

DISTRIBUTION: Ceylon (type locality), Philippine Is., Micronesia (?).

TRUK. WENA (Moen): Epinup, Mar. 1949, Potts.

The single Micronesian specimen available resembles *P. thespesiae* in most discernible details, but the specimen is not of a condition satisfactory

for a complete and detailed comparison. It is, therefore, tentatively referred to Green's species.

68. Pulvinaria urbicola Cockerell.

Pulvinaria urbicola Cockerell, 1893, Ent. Soc. London, Trans. for 1893, 160.—Zimmerman, 1948, Insects of Hawaii **5**: 342, fig. 173.

Pulvinaria sp. near *tyleri*, Fullaway, 1946, B. P. Bishop Mus., Bull. **189**: 159.

DISTRIBUTION: Jamaica (type locality), Barbados, Trinidad, Hawaii, Mariana Is., Caroline Is.

S. MARIANA IS. SAIPAN: Oleai, Nov. 1937, Esaki, on eggplant. GUAM: Feb. 1939, Oakley, on sweet potato vine; Oct. 1953, Liming, on *Capsicum*.

CAROLINE ATOLLS. SOROL: Dec. 1952, Krauss. SATAWAL: July 1958, Sproat, on *Premna* stems. LAMOTREK: Feb. 1950, Langford, on *Plumeria*; Lamotrek I., Feb. 1952, Beardsley, on *Plumeria* leaves. FARAULEP: Faraulep I., Jan. 1964, Owen, on *Pseuderanthemum* leaves.

HOSTS: *Capsicum*, eggplant, *Plumeria*, *Premna*, *Pseuderanthemum*, sweet potato. Merrill (1953: 106) lists this species from a number of additional hosts.

Ferris (*In* Zimmerman 1948: 342, fig. 173) has redescribed and figured specimens from Hawaii which seem to have been accepted as representing *P. urbicola*. Cockerell's types apparently are no longer available, so the correctness of this name is open to question. However, the available Micronesian specimens agree quite well with specimens from Honolulu ex *Ipomoea horsfalliae*, and these in turn appear to be the same thing as illustrated by Ferris. *Pulvinaria peninsularis* Ferris may be a synonym of this species.

Genus **Saissetia** Deplanche

Saissetia Deplanche, 1859, Soc. Linn. Normandie, Bull. **4**: 302 (not seen).—Steinweden, 1929, Ent. Soc. America, Ann. **22**: 224.

Type of genus: *Saissetia coffeae* Deplanche (= *Lecanium coffeae* Walker?).

Takahashi (1955–B: 26) established a new genus, *Parasaissetia*, with *Lecanium nigrum* Nietner as the type species, largely on the basis of the absence of a discal seta on the anal plates, the absence of free tibiotarsal articulations, and certain other characteristics of the type species. I have not recognized Takahashi's genus here, as the differences cited do not seem of sufficient importance to warrant the separation of *S. nigra* from other species now assigned to the genus *Saissetia*.

The three Micronesian species here assigned to *Saissetia* are all common, widespread forms.

KEY TO MICRONESIAN SPECIES OF SAISSETIA
(In part after Zimmerman, 1948)

1. Fully mature females oval and but slightly convex, or elongate and moderately convex; brown or black; anal plates without a discal seta; very small tubular ducts all of one size present in a submarginal ventral zone..... **nigra**
   Fully mature females highly convex, normally circular in outline; anal plates each with a well-developed discal seta..... 2
2. Mature female light brown; dorsal derm smooth, with numerous small oval or circular clear areas; marginal zone of ventral tubular ducts containing ducts of two distinct sizes and shapes, the larger having apical filaments as broad as basal tube..... **coffeae**
   Mature female very dark; derm slightly rugose and normally with a median transverse and two submedian longitudinal ridges forming an H-shaped figure; ventral zone of tubular ducts composed of ducts of one size and shape only, these with a slender apical filament..... **oleae**

69. Saissetia coffeae (Walker).

Lecanium coffeae Walker, 1852, List Homopt. Ins. Brit. Mus. **4**: 1079.

Saissetia coffeae: Deplanche, 1859, Soc. Linn. Normandie, Bull. **4**: 203 (not seen).—Williams, 1957, Entomologist **90**: 314.

Lecanium hemisphaericum Targioni-Tozzetti, 1867, Soc. Ital. Sci. Nat., Mem. **3** (3): 26.

Saissetia hemisphaerica: Cockerell, 1901, Ent. Student **2**: 32 (not seen).—Zimmerman, 1948, Insects of Hawaii **5**: 320, fig. 164.

Coccus coffeae: Kirkaldy, 1902, Fauna Hawaiiensis **3** (2): 105.

DISTRIBUTION: Widespread.

S. MARIANA IS. TINIAN: Naval Airport, June 1946, Townes, on *Graptophyllum pictum* or *Pseuderanthemum atropurpureum*, and *Cycas circinalis*. GUAM: Aug. 1953, Liming, on oleander and Chinese gardenia.

PALAU. BABELTHUAP: July 1946, Townes, on *Mussaenda sericea*. KOROR: July 1946, Oakley, on *Mussaenda*; Mar. 1948, Maehler, on *Ixora* sp.; July 1953, Beardsley, on *Gardenia* leaves.

YAP. In quarantine at Hawaii, Feb. 1952, Makino, on birdsnest fern.

MARSHALL IS. ENIWETOK: Medren I., Sept. 1957, Tuthill, on *Pseuderanthemum*. KWAJALEIN: Kwajalein I., July 1958, Clagg. MAJURO: Majuro I., Aug. 1946, Oakley, on lime; Majuro I., May 1958, Owen, on *Plumeria* and *Pseuderanthemum* leaves.

HOSTS: Merrill (1952: 106) lists this species from a variety of hosts. In Micronesia it has been reported from citrus (lime), coffee (Fullaway 1946: 159) and several common ornamentals such as *Pseuderanthemum*, *Ixora*, and *Plumeria*. Takahashi (1936–1942) recorded this species (as *S. hemisphaerica*) from Pagan, Saipan, Rota, Yap, Palau, Truk, and Ponape, on various hosts.

70. Saissetia nigra (Nietner).

Lecanium nigrum Nietner, 1861, Ceylon Times **31** : 9 (not seen).
Lecanium (*Saissetia*) *nigrum:* Cockerell and Parrott, 1899, The Industrialist, 163 (not seen).
Saissetia nigra: King, 1902, Psyche **9** : 296.—Zimmerman, 1948, Insects of Hawaii **5** : 324, fig. 167.
Coccus nigra: Kirkaldy, 1903, Fauna Hawaiiensis **3** (2) : 106.
Lecanium (*Saissetia*) *sideroxylium* Kuwana, 1909, New York Ent. Soc., Jour. **17** : 162.
Lecanium (*Saissetia*) *pseudonigrum* Kuwana, 1909, New York Ent. Soc., Jour. **17** : 162.
Parasaissetia nigra: Takahashi, 1955, Ins. Matsumurana **19** : 26.

DISTRIBUTION: Widespread (type locality: Ceylon).

BONIN IS.: No locality or date, Kuwana, on *Sideroxylon ferrugineum* and host not specified. Kuwana's Bonin Islands material is presumably that upon which he based the descriptions of *Lecanium sideroxylium* and *L. pseudonigrum*. Type material of both species was examined by Takahashi who concluded that both should be regarded as synonyms of *S. nigra* (1955 : 70).

VOLCANO IS. Iwo Jima: July 1958, Owen, on *Trema* leaves.

S. MARIANA IS. Saipan: Native village, June 1946, Oakley, on *Ficus*. Tinian: Camp Churo, May 1946, Oakley, on cotton; Lake Hagoya, June 1946, Townes, on *Ceiba pentandra*. Guam: Piti, May–June 1911, Fullaway, on *Ceiba*, "Ceara rubber," cotton, and *Sida rhombifolia*; Nov. 1937, Oakley, on *Pandanus*; Jan. 1938, Oakley, on corn and *Neottopteris nidus*; Piti, Mar. 1938, Oakley, on kapok; Dededo, July 1939, on coffee; Ritidian Point, June 1945, Gressitt; Oca Point, June 1945, Bohart and Gressitt; Agana, Apr. 1946, Krauss; Talofofo, Dec. 1947, Maehler, on *Manihot esculenta*; Barrigada, Nov. 1952, Gressitt, on *Hibiscus*.

PALAU. Koror: Mar. 1948, Maehler, on cassava; Sept. 1953, Beardsley, on *Eugenia javanica*; Jan. 1954, Beardsley, on cassava, *Plumeria*, and *Scaevola*. Peleliu: 1945, Dorsey. Angaur: Nov. 1949, Owen, on eggplant.

YAP. Yap: Kolonia, Aug. 1950, Goss, on cassava; Kolonia, Mar. 1949, Maehler, on taro and *Manihot esculenta*; Mar. 1954, Beardsley, on *Canna* leaf.

TRUK. Wena (Moen): May 1946, Oakley, on *Manihot esculenta*; June 1946, Townes, on *Premna*; Feb. 1948, Dybas; Feb. 1948, Maehler, on *Manihot esculenta*; Iras, Apr. 1949, Potts; Feb. 1953, Gressitt, on tapioca (cassava). Tonoas (Dublon): Oct. 1952, Beardsley, on *Manihot esculenta*. Ton (Tol): May 1946, Oakley, on *Annona muricata*.

KUSAIE. Lele, Aug. 1946, Oakley, on orange and *Plumeria*.

GILBERT IS. Tarawa: Aug. 1956, Brown, on coconut; Bairiki I., Nov.

1957, Krauss, on leaves of *Ficus* sp. BUTARITARI: Butaritari I., Dec. 1957, Krauss, on *Ficus* sp. leaves.

HOSTS: Reported hosts in Micronesia include cassava (*Manihot esculenta*), citrus, coconut, coffee, cotton, eggplant, and *Pandanus*, as well as a variety of ornamental and uncultivated plants. Takahashi (1936–1942) recorded this species from Pagan, Saipan, Rota, Yap, Palau, Truk, and Ponape, on cassava, citrus, cotton, eggplant, kapok, *Terminalia*, and several other hosts.

71. Saissetia oleae (Bernard).

Chermes oleae Bernard, 1782, Hist. Nat. Acad. Marseille, Mem., p. 108 (not seen).

Coccus oleae Olivier, 1791, Encycl. Méth., Hist. Nat. Ins. (not seen).

Lecanium oleae: Walker, 1852, List Homopt. Ins. Brit. Mus. **4**: 1070.

Saissetia oleae: Cockerell, 1901, Ent. Student **2**: 31.—Zimmerman, 1948, Insects of Hawaii **5**: 328, fig. 168.

Coccus oleae: Kirkaldy, 1902, Fauna Hawaiiensis **3** (2): 106.

DISTRIBUTION: Widespread (type locality: Europe?).

S. MARIANA IS. SAIPAN: June 1946, Townes, on *Crotalaria saltiana*; Afetna Point, June 1946, Townes, on *Terminalia catappa*. GUAM: in quarantine at San Francisco, Feb. 1945, Galbraith, on *Barringtonia speciosa*; Mt. Bolanos, Aug. 1952, Krauss; Mt. Lamlam, Oct. 1952, Krauss, on *Crotalaria* stem; Nov. 1953, Liming, on *Erythrina variegata*.

PALAU. KOROR: July 1953, Beardsley, on wild ginger. NGERKABESANG (Arakabesan): July 1946, Townes, on *Psidium guajava*. PELELIU: July 1946, Townes, on capparidaceous tree.

TRUK. WENA (Moen): Feb. 1954, Beardsley, on twigs of citrus.

MARSHALL IS. UJELONG: Ujelong I., Oct. 1953, Beardsley, on twigs of *Sida* sp.

HOSTS: This species is a well-known pest of citrus in California and elsewhere. In Micronesia it is here recorded from citrus, guava, soursop and several ornamental and uncultivated plants. Takahashi (1939, 1942) records this species from Pagan on legume and from Palau on *Annona muricata*.

Genus **Vinsonia** Signoret

Vinsonia Signoret, 1872, Soc. Ent. France, Ann. V, **2**: 33.

Type of genus: *Vinsonia pulchella* Signoret (= *Coccus stellifera* Westwood).

This monotypical genus appears to be allied to *Ceroplastes*.

72. Vinsonia stellifera (Westwood).

Coccus stellifer Westwood, 1871, Ent. Soc. London, Proc. for 1871 : iii.
Vinsonia pulchella Signoret, 1872, Soc. Ent. France, Ann. V, **2** : 34.
Vinsonia stellifera: Douglas, 1888, Ent. Mo. Mag. **25** : 152.—Green, 1909, Coccidae of Ceylon, pt. **4** : 280, pl. 106.

DISTRIBUTION: Siam (type locality), Ceylon, West Indies, Central and South America, Caroline Is.

PALAU. KOROR: July 1946, Oakley, on coconut; Mar. 1948, Maehler, on unidentified plant; Jan. 1954, Beardsley, on mango leaves; June 1958, Owen, on coconut. ANGAUR: Dec. 1949, on coconut leaves.

PONAPE. Colonia, Aug. 1946, Oakley, on *Eugenia*; Sankaku, Sept. 1950, Adams.

HOSTS: Recorded in Micronesia from *Artocarpus heterophyllus* (jackfruit), coconut, *Garcinia mangostana* (mangosteen), *Nipa* palm, and *Plumeria*. Reported from a number of additional hosts elsewhere (see Merrill, 1953). Takahashi (1939, 1942) recorded this species from Koror and Babelthuap, Palau Is., from *Artocarpus integer* (= *A. heterophyllus*), *Garcinia mangostana*, *Nipa* palm, and *Plumeria acuminata*.

FAMILY ASTEROLECAŃIIDAE

The Asterolecaniidae are generally considered allied to the Coccidae and other "lecanoid" families (Balachowsky, 1942). The family has been characterized satisfactorily by Ferris (1955). Cytogenetic evidence has been presented recently which indicates that the armored scales (Diaspididae) probably arose from the asterolecaniids or asterolecaniid-like ancestors (Brown and McKenzie, 1962).

A single genus, *Asterolecanium*, is represented in the Micronesian collections.

Genus **Asterolecanium** Targioni-Tozzetti

Asterolecanium Targioni-Tozzetti, 1869, Soc. Ital. Sci. Nat. Atti **11** : 734.—Russell, 1941, U.S. Dept. Agric., Misc. Pub. **424** : 4.—Ferris, 1955, Atlas Scale Ins. North America **7** : 15.

Type of genus: *Coccus aureus* Boisduval (= *Lecanium epidendri* Bouché).

The Micronesian material at hand contains representatives of six species, five of which are associated with various species of bamboos. The sixth species, *A. pustulans* (Cockerell), occurs on a variety of dicotyledonous hosts and is perhaps the most widely distributed and pestiferous member of the family.

Two additional species are listed by Takahashi but are not among the specimens which I have examined. One of these, *A. pseudolanceolatum* Takahashi, is a bamboo-infesting form, while the other, identified only as "*Asterolecanium* sp." is listed by Takahashi (1939 : 262) from "Oleai" (= Woleai) Atoll, on *Plumeria*.

The genus *Asterolecanium* has been monographed for the entire world by Russell (1941), and this work should be consulted for definitions of the morphological terms used in the key to Micronesian species below. All the described species known to occur in Micronesia are redescribed and figured by Russell.

Key to Known Micronesian Species of Asterolecanium
(In part adopted from Russell, 1941)

1. Dorsal tubes absent; submarginal setae in a complete row, present cephalad as well as caudad of anterior spiracles; on various dicotyledonous hosts 2
   Dorsal tubes present; submarginal setae in an incomplete row, absent cephalad of anterior spiracles, and usually cephalad of posterior spiracles; on bamboos 3
2. Dorsum with relatively numerous large 8-shaped (geminate) pores scattered over surface, sometimes with a tendency toward arrangement into transverse bands ..... **pustulans**
   Dorsum with only a few large 8-shaped pores situated in middle of posterior part ..... sp. (Woleai)
3. With 2 to several quinquilocular or multilocular disc pores on ventral surface near genital opening 4
   Without quinquilocular or multilocular disc pores on venter near genital opening 6
4. Apex of abdomen with 3 pairs of setae, rounded, not noticeably incised medially, without an elongate apical seta; apical part of abdomen usually narrowed and produced posteriorly, giving body a gourd-shaped appearance ..... **coronatum**
   Apex of abdomen with 4 pairs of setae; body not gourd-shaped, if narrowed posteriorly, then apex incised medially and with an elongate apical seta 5
5. With 2 quinquilocular pores posterior to genital opening and none anterior; marginal row of 8-shaped pores terminating at three or four times length of an apical seta from base of seta; shape moderately slender ..... **pseudolanceolatum**
   With many multilocular pores near vulva, both anterior to and posterior to opening; marginal row of 8-shaped pores terminating much less than twice length of an apical seta from base of seta; body relatively stout ..... **bambusae**
6. Dorsum with larger 8-shaped pores about 10 μ diameter present in addition to minute pores; with a rather sparse row of disc pores dorsad or marginal 8-shaped pores ..... **pseudomiliaris**
   Dorsal 8-shaped pores if present, extremely minute, about 2 μ in length; without a row of disc pores dorsad of marginal 8-shaped pores 7
7. Marginal row of quinquilocular pores starting between antennae and anterior spiracular pore bands, and ending about half-way between posterior spiracular pore bands and hindmost marginal 8-shaped pores ..... **miliaris**
   Marginal quinquilocular pores absent or with 2 to 15 (usually less than 6) such pores where each spiracular pore band meets body margin, interrupted between anterior and posterior spiracular pore bands ..... **robustum**

73. Asterolecanium bambusae (Boisduval).

Chermes bambusae Boisduval, 1869, Insectologie Agr. **2**: 261 (not seen).
Asterolecanium bambusae: Signoret, 1870, Soc. Ent. France, Ann. IV, **10**: 280.—Russell, 1941, U.S. Dept. Agric., Misc. Pub. **424**: 47, figs. 6, J–O, 7, A–G).—Ferris, 1955, Atlas Scale Ins. North America **7**: 18, fig. 7.

DISTRIBUTION: Widespread (type locality: Algeria).

S. MARIANA IS. TINIAN: Lake Hagoi (Hagoya), Aug. 1946, Oakley, on bamboo. GUAM: Guam Experiment Station (no date), on *Bambusa vulgaris*; Talofofo, June 1946, Townes, on *Aglaia* ?; Agana, Dec. 1947, Maehler, on bamboo; Agana, Feb. 1954, McClure, on *Bambusa* sp.

PALAU. NGERKABESANG (Arakabesan): July 1947, Townes, on bamboo.

HOSTS: Various species of bamboo. The "*Aglaia* ?" record is very likely erroneous. Takahashi (1936–1942) recorded this species from Saipan and Palau, on bamboo.

74. Asterolecanium coronatum Green.

Asterolecanium coronatum Green, 1909, Coccidae of Ceylon **4**: 327, pl. 124.—Russell, 1941, U.S. Dept. Agric., Misc. Pub. **424**: 72, figs. 16, N, 17, A–E.

DISTRIBUTION: Ceylon (type locality), Taiwan, Caroline Is.

PALAU. KOROR: July 1953, Beardsley, on bamboo stems. NGERKABESANG (Arakabesan): July 1946, Townes, on bamboo.

HOST: Bamboo.

75. Asterolecanium miliaris (Boisduval).

Chermes miliaris Boisduval, 1869, Insectologie Agr. **2**: 261 (not seen).
Asterolecanium miliaris: Signoret, 1870, Soc. Ent. France, Ann. IV, **10**: 281.—Ferris, 1955, Atlas Scale Ins. North America **7**: 20.
Asterolecanium miliaris variety *miliaris:* Russell, 1941, U.S. Dept. Agric., Misc. Pub. **424**: 129, fig. 41, B–G.

DISTRIBUTION: Widespread (type locality: Algeria).

S. MARIANA IS. TINIAN: Lake Hagoi (Hagoya), June 1946, Oakley, on bamboo. GUAM: Mt. Santa Rosa, May 1945, Bohart and Gressitt, on bamboo leaves; Agana, Aug. 1952, Krauss, on bamboo leaves.

PALAU. KOROR: Nov. 1947, Dybas, on bamboo; July 1953, Beardsley, on bamboo stems. NGERKABESANG (Arakabesan): July 1946, Townes on bamboo.

PONAPE. Colonia, Jan. 1949, Ross, on *Bambusa* sp.; Madolenihm (Metalanum) Plantation, Aug. 1946, Oakley, on bamboo.

HOSTS: Various species of bamboo.

76. Asterolecanium pseudolanceolatum Takahashi.

Asterolecanium pseudolanceolatum Takahashi, 1933, Formosa Govt. Res. Inst., Dept. Agric. Rept. **60**: 34.—Russell, 1941, U.S. Dept. Agric., Misc. Pub. **424**: 158, fig. 54, A–G.

DISTRIBUTION: Formosa (type locality), Micronesia (Ponape) ?

HOSTS: *Bambusa* spp.

Takahashi (1939: 261) lists this species from several localities on Ponape on *Bambusa* sp. No specimens of this species have been recognized in Micronesian material at hand.

77. Asterolecanium pseudomiliaris Green.

Asterolecanium pseudomiliaris Green, 1922, Bombay Nat. Hist. Soc., Jour. **28**: 1036.—Russell, 1941, U.S. Dept. Agric., Misc. Pub. **424**: 160, fig. 54, H–S.—Ferris, 1955, Atlas Scale Ins. North America **7**: 25, fig. 10.

Asterolecanium charmoyi Green, 1924, Bull. Ent. Research **15**: 45.—Takahashi, 1936, Tenthredo **1**: 116; 1941, ibid. **3**: 217; 1942, ibid. **3**: 353.

DISTRIBUTION: Widespread (type locality: Ceylon).

S. MARIANA IS. GUAM: Agana, Aug. 1952, Krauss, on bamboo leaves.

PONAPE. Colonia, Jan. 1946, Ross, on *Bambusa* sp.

HOSTS: Bamboos. Takahashi has listed this species (as *A. charmoyi*) from Saipan, Palau Is. (Babelthuap and Koror), and from Ponape.

78. Asterolecanium pustulans (Cockerell).

Asterodiaspis pustulans Cockerell, 1892, Inst. Jamaica, Jour. **1**: 142.

Planchonia pustulans: Cockerell, 1893, Science Gossip **29**: 77.

Asterolecanium pustulans: Cockerell, 1893, Bot. Dept. Jamaica, Bull. **40**: 8.—Russell, 1941, U.S. Dept. Agric., Misc. Pub. **424**: 165, fig. 56, A–E.—Ferris, 1955, Atlas Scale Ins. North America **7**: 25, fig. 11.

DISTRIBUTION: Widespread (type locality: Jamaica).

S. MARIANA IS. GUAM: Jan 1927, Vandenburg, on *Flacourtia ramontchi*; Talofofo, Dec. 1947, Maehler, on unidentified plant; Agana, Oct. 1952, Krauss, on oleander stem; Aug. 1953, Liming, on oleander; Oct. 1953, Liming, on *Hibiscus mutabilis*.

PALAU. KOROR: July 1953, Beardsley, on *Macaranga* sp. stems; July 1953, Peterson, on twigs of *Leucaena glauca*; Aug. 1958, Owen, on *Cassia grandis* stems, *Morinda citrifolia* stems, and *Plumeria* stems.

TRUK. WENA (Moen): Feb. 1954, Beardsley, on breadfruit bark.

MARSHALL IS. LIKIEP: Likiep I., Aug. 1946, Oakley, on breadfruit. MAJURO: Majuro I., May 1958, Owen, on *Plumeria* petioles; Jaroj (Darrit) I., June 1958, Owen, on breadfruit petioles.

GILBERT IS. BUTARITARI: Butaritari I., Dec. 1957, Krauss, on *Morinda citrifolia*. TARAWA: Teaoraereke I., Nov. 1957, Krauss, on *Morinda citrifolia*.

HOSTS: Breadfruit, *Plumeria*, *Hibiscus mutabilis*, *Leucaena leucocephala* (= *L. glauca*), *Morinda citrifolia*, and various other ornamental and wild hosts. Recorded from a wide variety of host plants, but not bamboo, from various parts of the world.

79. Asterolecanium robustum Green.

Asterolecanium miliaris variety *robustum* Green, 1908, India Dept. Agric., Mem. Ent. II, **15** : 19.—Russell, 1941, U.S. Dept. Agric., Misc. Pub. **424** : 130, fig. 41, H.

Asterolecanium miliaris variety *longulum* Green, 1909, Coccidae of Ceylon, pt. **4** :339, pl. 129.—Fullaway, 1946, B. P. Bishop Mus., Bull. **189** : 158.

Asterolecanium robustum: Ferris, 1955, Atlas Scale Ins. North America **7** : 26.

DISTRIBUTION: Widespread (type locality: India).

S. MARIANA IS. GUAM: Sept. 1953, Liming, on bamboo.

PALAU. BABELTHUAP: Ulimang, Dec. 1947, on bamboo. KOROR: Nov. 1947, Dybas, on bamboo; July 1953, Beardsley, on bamboo leaves; Aug. 1958, Owen, on *Bambusa vulgaris* leaves.

PONAPE. Colonia, Jan. 1949, Ross, on *Bambusa* sp.

This form was treated as a variety of *A. miliaris* by Russell (1941), but I have followed Ferris in treating it as a distinct species. Russell (1941 : 122) found that the form described by Green as *Planchonia miliaris* var. *longa* in 1896 is not the same as that which he considered as *Asterolecanium miliaris* var. *longum* in 1909, but the latter is identical with that described as *A. miliaris* var. *robustum* by Green in 1908.

In the Micronesian specimens which I have collected, *A. robustum* is a more slender elongate form found on leaves of the host, while *A. miliaris* is a relatively robust form occurring principally on stems and twigs. Russell (1941 : 130), however, does not consider body form to be a character of consistant utility in separating these forms. Additional study using material reared under controlled conditions should make it possible to determine whether these closely related forms are actually distinct species, or merely varieties.

80. Asterolecanium sp.

Asterolecanium sp., Takahashi, 1939, Tenthredo **2** (3) : 262.

Takahashi reported an unidentified species of *Asterolecanium*, allied to *A. pustulans* but possessing a much smaller number of the large dorsal 8-shaped pores, from Falulap Islet, Woleai Atoll. This species is not represented among the Micronesian survey material at hand.

Family DIASPIDIDAE

The armored scales constitute perhaps the largest group within the Coccoidea, and are among the most important of agricultural pests. The 64 species here recorded for Micronesia include a number of pestiferous forms collected from various cultivated plants. Many of these are species which have been dispersed widely through commerce. Several of the new species described on the pages following have been collected at a single locality on non-cultivated plants, and some of these are probably endemic or indigenous to Micronesia. The genus *Lepidosaphes* is particularly well represented and includes six species not known outside Micronesia. Many additional new diaspidids are doubtless present in Micronesia, awaiting discovery by assiduous collectors willing to direct their attention to the native, non-cultivated vegetation of the islands.

For a consideration of the morphological terms employed in the keys and descriptions which follow, the reader is referred to works by Ferris (1942), McKenzie (1956), and Zimmerman (1948).

Subfamily DIASPIDINAE

This group, the typical armored scales, is the only one of the two commonly recognized subfamilies of the Diaspididae which is represented in the Micronesian collections at hand. Representatives of the second group, the Phoenicoccinae, generally considered a subfamily of the Diaspididae, eventually may be found infesting some of the native or introduced palms in Micronesia.

Key to Known Tribes and Genera of Micronesian Diaspidinae
(partially after Ferris, 1942)

ADULT FEMALES

1. Pygidium without plates or segmentally arranged gland spines; with no paired lobes, but commonly with a single median lobe; macroducts usually small, short, numerous, and never in segmentally arranged rows, usually abundant on venter as well as on dorsum; on grasses and bamboos. Tribe Odonaspidini..... **Odonaspis**

   Pygidium normally with plates or gland spines; pygidial lobes usually present, median pair rarely united into a single lobe; macroducts usually present; commonly at least partly arranged in segmental rows or series; on various hosts..... 2

2. Pygidial ducts minute, not definitely discernible as 1- or 2-barred; pygidium not excised at apex; adult female very small, completely enclosed within second exuvium; a single tiny, seedlike species known only from bark of mango. **Radionaspis**

   Pygidial ducts larger, usually definitely distinguishable as either 1- or 2-barred type, or if not, then pygidium excised at apex; adult female only rarely completely enclosed in second exuvium..... 3

3. Macroducts of the 2-barred type; second pygidial lobes usually showing some evidence of being bilobate; gland spines normally present, occasionally replaced by fringed plates, but if so then with gland tubercles present; anterior spiracle commonly with associated disc pores; antennal tubercles commonly with 2 or more setae. Tribe Diaspidini 16
   Macroducts of the 1-barred type; second pygidial lobes never bilobate; fringed plates normally present; gland tubercles usually absent; anterior spiracle normally without associated disc pores; antennal tubercles rarely with more than 1 seta. Tribe Aspidiotini 4

4. Dorsum of pygidium with a well-developed reticulum or mosaic appearance formed by many small areas of weaker sclerotization 5
   Dorsum of pygidium without such a mosaic reticulum, or at most very weakly suggested 6

5. With 2 pairs of elongate pygidial paraphyses, each terminating at anterior end in a conspicuous circular knob ..... **Duplaspidiotus**
   Without such conspicuously capitate pygidial paraphyses ..... **Pseudaonidia**

6. Pygidium with paraphyses arising from bases of lobes, or at sites of obsolete lobes (other than mere prolongations of bases of median lobes and other than mere sclerotization of the fold about a pore or pore furrow) 7
   Pygidium without such paraphyses, other than modifications noted above 13

7. Prosoma of mature female sclerotized and expanded laterally, lateral lobes often enclosing pygidium when fully developed, body distinctly reniform in shape 8
   Prosoma not so developed 9

8. Mesal paraphysis of first interlobular space slightly to distinctly elongate, terminating in a well-developed sclerotized knob ..... **Africonidia**
   Mesal paraphysis of first interlobular space without such a knob ..... **Aonidiella**

9. Paraphyses arising only from basal angles of lobes, thus forming merely paired supports for lateral margins of intersegmental poriferous furrows ..... **Hemiberlesia**
   At least 1 paraphysis arising from center of at least 1 interlobular space, usually between second and third lobes, frequently with paraphyses along margin beyond third lobe 10

10. Pygidium with conspicuous branched plates between third and fourth lobes, exceeding lobes in length ..... **Chrysomphalus**
    Pygidial plates small or reduced to mere points, not exceeding lobes in length, sometimes wanting 11

11. Plates present in mesal and first 2 interlobular spaces, these apically chelate, fingers of claws slightly sclerotized and connected by a very delicate membrane ..... **Furcaspis**
    Plates if present not so formed 12

12. Dorsum of thorax and abdominal segments anterior to the pygidium, except for intersegmental areas, strongly sclerotized ..... **Semelaspidus**
    Dorsum of thorax and anterior abdominal segments unsclerotized ..... **Melanaspis**

13. Usually with 3 or 4 pairs of pygidial lobes definitely developed; margins of pygidium not noticeably crenulate 14
    With but 2 pairs of pygidial lobes developed, the third sometimes represented by a sclerotized point; pygidial margin moderately to strongly crenulate .. **Aspidiella**

14. Prosoma sclerotized, venter with a conspicuous reticulate meshwork of fine lines ..... **Anastomoderma**
    Prosoma unsclerotized, without such a reticulate meshwork 15

15. Fourth pair of pygidial lobes definitely present in form of a small acute tooth ..... **Octaspidiotus**
    Fourth pair of pygidial lobes absent ..... **Aspidiotus**

16. Median lobes of pygidium yoked basally by an internal sclerosis.....17
Median lobes of pygidium not yoked basally.....21

17. Body conspicuously longer than broad, prosoma swollen, wider than posterior parts of body, a marked constriction between prosoma and posterior part of body.....**Aulacaspis**
Body not so formed, if elongate then prosoma narrower than middle part of body, without a marked constriction at its posterior margin.....18

18. Body of mature female turbinate; female scale circular or oval.....**Pseudaulacaspis**
Body of mature female and female scale both elongate.....19

19. Median lobes of pygidium divergent, forming a distinct median notch.....20
Median lobes of pygidium contiguous or nearly so.....**Pinnaspis**

20. Body of mature female completely enclosed in second exuvium; antennal tubercles large, their mesal margins moderately to conspicuously elongated to form a prominent projection.....**Fiorinia** (in part)
Body of mature female not completely enclosed in second exuvium; antennal tubercles smaller, not prolonged into conspicuous projections.....**Phenacaspis**

21. Marginal pygidial macroducts with long axis of orifices set longitudinally or diagonally, sclerotized rim, if present, similarly disposed.....22
Marginal pygidial macroducts with long axes of orifices set transversely or essentially so, each with orifice surrounded by a transverse oval sclerotized rim .....**Parlatoria**

22. Body of mature female broadly turbinate or pyriform.....23
Body of mature female elongate oval to fusiform.....24

23. Prosoma strongly sclerotized; with a strong clavate internal sclerosis extending anteriorly from base of each median lobe of pygidium.....**Howardia**
Prosoma unsclerotized; without such an internal sclerosis extending from base of each median lobe.....**Diaspis**

24. Dorsum of pygidium with a coarse reticulate pattern of sclerotization; female scale very elongate and slender.....**Ischnaspis**
Without such a reticulate pattern on dorsum of pygidium; female scale usually less elongate.....25

25. With an elongate club-shaped internal sclerotized process arising from base of each mesal lobe of pygidium.....**Andaspis**
Without such an internal sclerotized process arising from each mesal lobe.....26

26. Adult female completely enclosed within second exuvium; median lobes of pygidium divergent, serrate on their mesal margins, apex of abdomen conspicuously notched; pygidial ducts extremely small, reduced to a few along dorsal margins; perivulvar pores absent.....one species of **Fiorinia**
Adult female not enclosed in second exuvium; perivulvar pores present or absent, if absent, then pygidial macroducts relatively large and numerous.....27

27. Median, second, and sometimes third pair of pygidial lobes well developed; without small macroducts on dorsum and venter of head.....28
Pygidial lobes, except for median pair, poorly developed, scarcely discernible; small macroducts scattered on dorsum and venter of head and elsewhere on body.....**Palauaspis**

28. Second and third pairs of pygidial lobes both equally well developed, strongly bilobate.....**Unaspis**
Third pair of pygidial lobes represented only by variously shaped sclerotized points, or absent.....**Lepidosaphes**

TRIBE ASPIDIOTINI

Genus **Africonidia** McKenzie

Africonidia McKenzie, 1947, Dept. Agric., California, Bull. **36** (3) : 110.

Type of genus: *Africonidia halli* McKenzie (= *Gymnaspis africana* Newstead).

Balachowsky (1958) has placed four species, all African, in McKenzie's monotypic genus. The new species from Palau, Caroline Islands, which is described below, clearly belongs with those which Balachowsky has assigned to this genus, and it appears to constitute the first extra-African record for this group.

81. Africonidia macdanieli Beardsley, n. sp. (fig. 30).

Female. Length of slide-mounted specimens 0.9–1.35 mm. Body at full maturity strongly reniform, prosoma expanded laterally and curving posteriorly on each side to enclose pygidium; strongly sclerotized. Pygidium with three discernible pairs of lobes; median pair well developed, broad, fairly close together, the distance between them about 0.5 the width of one, notched on inner and outer margins near apex, apically rounded. Second pair of lobes much smaller, less than 0.5 length of median pair, apically rounded, weakly notched on outer margins. Third pair of lobes reduced to small sclerotized humps. Fourth lobes unrecognizable or represented by a somewhat more strongly sclerotized region on margin of pygidium. Pygidial paraphyses small, the largest arising on mesal border of poriferous furrow between median and second lobes, about as long as, or slightly shorter than mesal lobe and terminating anteriorly in a conspicuous clavate process. A smaller paraphysis in inner margin of apex of second interlobular poriferous furrow sometimes appearing weakly clavate. Fringe plates present on margin of pygidium as far forward as site of obsolete fourth lobes; these about as long as, or slightly longer than median lobes. Perivulvar pores absent. Dorsal pygidial macroducts with external pores small, the orifice about 3 μ wide; moderately elongate, about 100–140 μ long; distributed in three pairs of poriferous furrows. Mesal furrows each with around 4 or 5 ducts with orifices situated well behind anal opening; second furrows each with 5 to 7 ducts with orifices in a line extending anteriorly to well in front of anal opening; third furrows each with 2 to 4 ducts with orifices near margin of pygidium. Anal orifice of moderate size, its posterior margin situated about 3 times length of a median lobe anterior to apex of pygidium, or about as far cephalad as site of obsolete fourth pygidial lobes.

Female scale circular, light brown, second exuvium central.

Described from 15 specimens. Holotype, female (BISHOP 6146) and 1 paratype on one slide, Palau Is., Ulebsehel (Auluptagel), July 20, 1956, B. McDaniel, on unknown vine; 13 paratypes (US, BISHOP, UH, McDaniel), on 8 slides, same data as type.

DISTRIBUTION: Caroline Is. (Palau).

Africonidia macdanieli may be distinguished from all other species presently placed in this genus by the relatively large and conspicuously clavate paraphysis which arises on the mesal border of the poriferous furrow between the median and second pygidial lobes on each side. Certain of the species placed in *Africonidia* by Balachowsky (for example, *A. carreti* Balachowsky) exhibit a greater development of the paraphyses than does the type of the genus, *A. africana*, but none of these have the paraphyses so strongly clavate as in *macdanieli*.

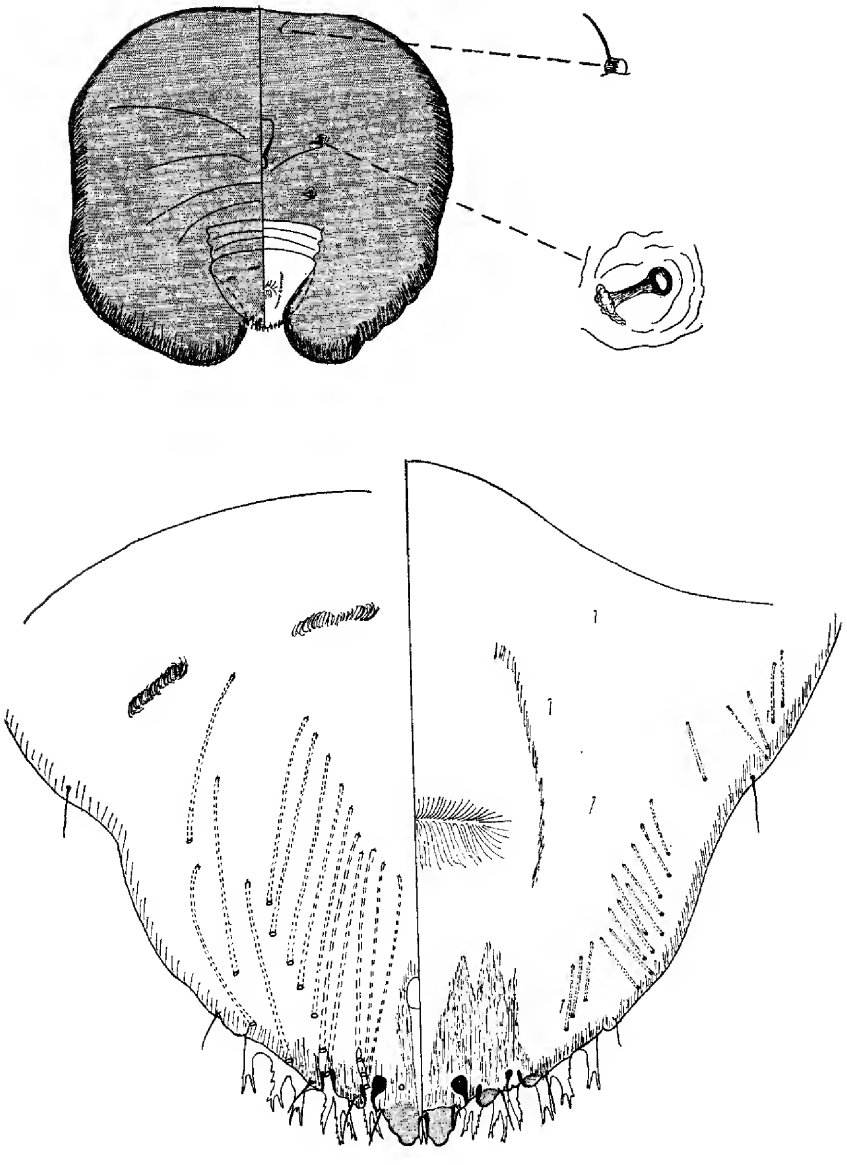

FIGURE 30.—*Africonidia macdanieli*, adult female, dorsal and ventral aspects and details.

Genus **Anastomoderma,** new genus

Recognition characters: Diaspidinae with single barred ducts; 3 pairs of unilobate pygidial lobes; fringed plates present along margin of pygidium; gland tubercles absent; spiracles without associated disc pores; antennal tubercles each with a single seta. Dorsum of pygidium simple, without a reticulum or mosaic formed by areas of weak and strong sclerotization; pygidial paraphyses absent. Body of mature female turbinate; prosoma strongly sclerotized, the ventral surface with a conspicuous reticulate meshwork formed by numerous intersecting fine wavy lines.

Type of genus: *Anastomoderma palauensis*, new species.

Allied to *Aspidiotus* Bouché, but the latter, as defined by Ferris (1941: 37), is restricted to species with the prosoma membranous at maturity. The sclerotized prosoma with its distinctive reticulate venter will distinguish *Anastomoderma* from any other known genus of the Aspidiotini.

82. **Anastomoderma palauensis** Beardsley, n. sp. (fig. 31).

Female. Length of slide-mounted specimens 0.6–0.7 mm.; body distinctly turbinate. Pygidium with 3 well-developed pairs of lobes; median pair large, close together, with a single narrow plate between, indistinctly subapically notched on outer margins, with a narrow internal basal sclerosis extending anteriorly from each lobe for a distance about equal to length of lobe. Second and third lobes of equal size, about half as wide as median lobes, but nearly as long; outer margin of each conspicuously notched submedially. Fringe plates on margin of the pygidium about as long as lobes; 6 or 7 present anterior to the third lobes, 2 each between median and second, and between second and third lobes. Dorsum of pygidium with 3 poriferous furrows on each side; mesal furrow with 5 or 6 pores, the most anterior near level of posterior margin of anal opening; middle furrow with about 7 pores, the most anterior at about level of anterior margin of anus; outer furrow with 2 or 3 pores. Dorsal pore ducts moderately short, mostly around 30 μ long. A few smaller ducts opening on lateral margins of dorsum of abdominal segments 1 to 3. Venter with a few very small ducts along lateral margins of pygidium, and occasionally discernible elsewhere on body. Perivulvar pores absent. Prosoma strongly sclerotized dorsally; venter with a reticulate meshwork of fine intersecting lines as illustrated. Dorsum of abdominal segment 1 with a small sclerotized boss on each side near lateral margin.

Female scale brownish, roughly circular, living in shallow pits in gall-like callous growth on twigs of host.

Described from 12 specimens on 4 slides. Holotype, female (BISHOP 6147) and 3 paratypes on 1 slide, Palau Is., Koror, July 3, 1953, Beardsley, on *Premna integrifolia* twigs; 8 paratypes on 3 slides (BISHOP, US, UH), same data as type.

DISTRIBUTION: Caroline Is. (Palau). Endemic?

HOST: *Premna integrifolia*.

Genus **Aonidiella** Berlese and Leonardi

Aonidiella Berlese and Leonardi, 1895, Riv. Path. Vegetale **4**: 77.—McKenzie, 1938, Microent. **3** (1): 1.

Type of genus: *Aspidiotus aurantii* Maskell.

See McKenzie (1938) for a revisionary study of this genus.

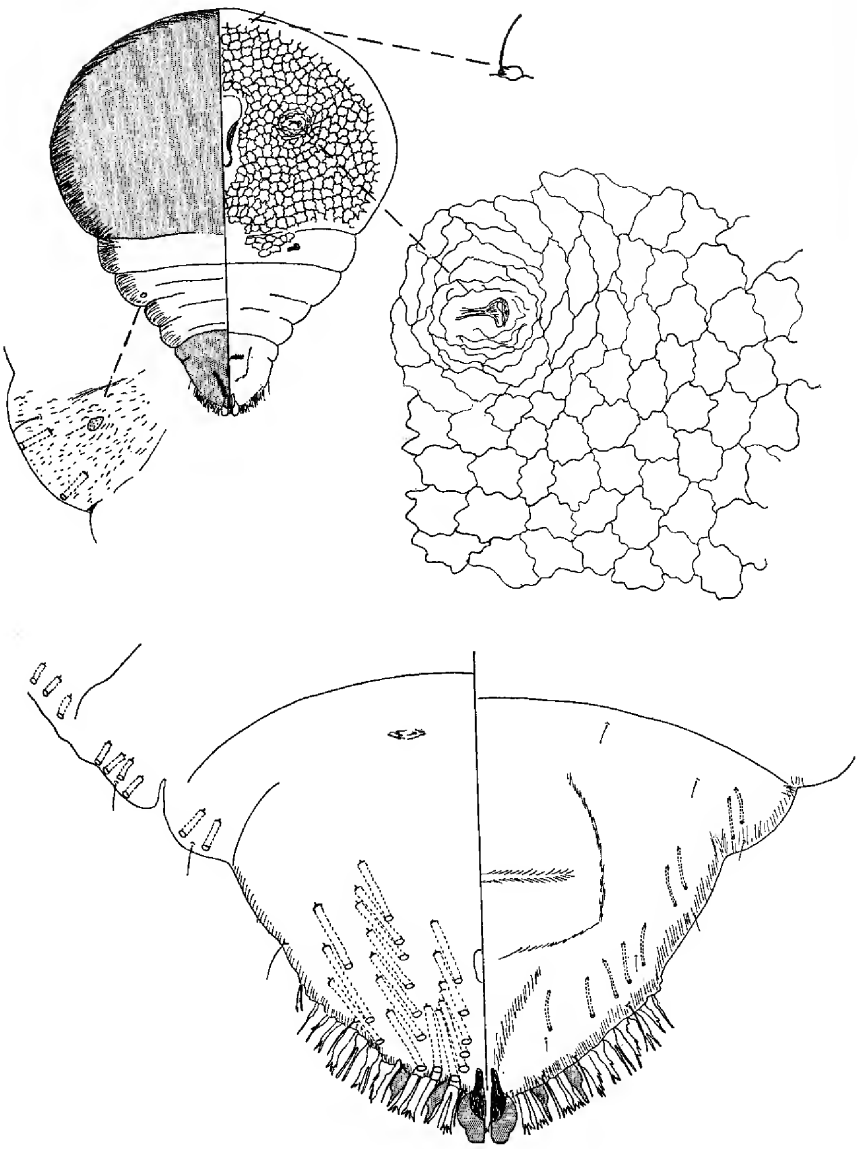

FIGURE 31.—*Anastomoderma palauensis*, adult female, dorsal and ventral aspects and details.

KEY TO KNOWN MICRONESIAN SPECIES OF AONIDIELLA
(adapted from McKenzie, 1938)

1. Perivulvar pores present 2
   Perivulvar pores absent 4
2. Prosomatic lobes weakly developed; 3 prepygidial abdominal segments each with a conspicuous group of ducts on lateral margin of dorsum ..... **orientalis**
   Prosomatic lobes well developed at maturity, body conspicuously reniform; prepygidial abdominal segments without such groups of ducts on lateral margins 3
3. With 6 to 10 perivulvar pores in 4 groups ..... **eremocitri**
   With 2 to 4 perivulvar pores in 2 groups ..... **comperei**
4. Prevulvar scleroses and apophyses present and well developed ..... **aurantii**
   Prevulvar scleroses and apophyses absent or very weakly developed ..... **inornata**

83. Aonidiella aurantii (Maskell).

Aspidiotus aurantii Maskell, 1878, New Zealand Inst., Trans. **11**: 199.
Aonidiella aurantii: Berlese and Leonardi, 1895, Riv. Path. Vegetale **4**: 83.—McKenzie, 1938, Microent. **3** (1): 6, fig. 3.

See McKenzie for a more complete listing of synonymy.

DISTRIBUTION: Widespread; Micronesia (?).

BONIN IS. Kuwana (1909: 160) lists this species from the Bonin Islands.

S. MARIANA IS. GUAM: In quarantine at San Francisco, Feb. 1945, Galbraith, on *Barringtonia speciosa.*

MARSHALL IS. BIKINI: In quarantine at Hawaii, June 1946, Duggins, on citrus fruit.

HOSTS: Citrus and various other hosts including coconut and *Artocarpus.* Takahashi (1936–1942) reported this species from Saipan, Rota, Palau and Truk, from citrus.

The establishment of this species in Micronesia remains to be confirmed. It is represented in the material at hand by but two records, both quarantine interceptions taken at ports outside Micronesia. Earlier published records from Micronesia may be the result of misidentifications.

84. Aonidiella comperei McKenzie.

Aonidiella comperei McKenzie, 1937, Univ. Calif. Pub. Ent. **6**: 327, fig. 4; 1938, Microent. **3** (1): 8, fig. 5.

DISTRIBUTION: India (type locality), Australia (?), Micronesia.

S. MARIANA IS. TINIAN: Marpo Valley, June 1946, Oakley, on papaya fruit; Naval Airport, June 1946, Townes, on *Cycas circinalis.* SAIPAN: Near Afetna Point, June 1946, Townes, on *Barringtonia asiatica*; June 1946, Oakley, on *Morinda citrifolia.*

PALAU. KOROR: Aug. 1958, Tellei, on coconut leaves and flower stalks.

YAP. YAP: May 1958, Tellei, on papaya.

CAROLINE ATOLLS. ULITHI: Falalop I., April 1954, Beardsley, on papaya leaves.

TRUK. TONOAS (Dublon): May 1946, Oakley, on papaya.

MARSHALL IS. AILINGLAPALAP: Bikajela (Bigatyelang) I., Aug. 1946, Oakley, on papaya. JALUIT: Imroj I., Aug. 1946, Townes, on papaya.

HOSTS: The type host is citrus. In Micronesia it has been taken on coconut and papaya among plants of economic importance. Heavy populations were several times encountered by me on papaya.

This form seems very closely allied to *A. eremocitri* McKenzie. The somewhat variable number of perivulvar pores present in both forms renders their separation rather difficult.

85. Aonidiella eremocitri McKenzie.

Aonidiella eremocitri McKenzie, 1937, Pan-Pacific Ent. **13**: 177, fig.; 1938, Microent. **3** (1): 9, fig. 6.

DISTRIBUTION: Australia (type locality), Caroline Is. (Palau).

PALAU. BABELTHUAP: Near Imeliik, Aug. 1953, Beardsley, on leaves of *Campnosperma brevipetiolata*. KOROR: Apr. 1954, Beardsley, on bark of *Glochidion*. PELELIU: July 1946, Oakley, on *Cocos nucifera*. NGURUKDABEL: Aug. 1953, Beardsley, on leaves of unidentified tree.

HOSTS: The type host is *Eremocitrus glauca*. In Micronesia, collections have been made from coconut and from several uncultivated hosts.

86. Aonidiella inornata McKenzie.

Aonidiella inornata McKenzie, 1938, Microent. **3** (1): 10, figs. 9, 10, A–E.—Zimmerman, 1948, Insects of Hawaii **5**: 361, fig. 185.

Aonidiella sotetsu: Fullaway, 1946, B. P. Bishop Mus., Bull. **189**: 161 (misidentification).

DISTRIBUTION: Philippine Is. (type locality), Hong Kong, Hawaii, Micronesia.

S. MARIANA IS. GUAM: Piti, 1936, Swezey, on citrus; Piti, July 1936, Swezey, on *Jasminum sambac*; School Farm, Piti, Feb. 1938, Oakley, on orange; Orote Point, Nov. 1937, Oakley, on *Ochrosia*; Inarajan, May 1939, Oakley, on lemon twigs; Togcha, May 1945, Bohart and Gressitt; Point Oca, June 1945, Bohart and Gressitt; Com. Mar. Hill (near Agana), Jan. 1949, Potts, on coconut leaf.

PALAU. KOROR: Feb. 1938, Esaki, on *Plumeria acuminata*; July 1956, McDaniel, on *Casuarina*.

YAP. YAP: Yaptown, July 1946, Townes, on *Rhizophora mucronata*; Oakley, July 1946, on orange and on citrus; Langford, Apr. 1950, on *Citrus* leaf; Krauss, Oct. 1952, on *Citrus* leaf.

CAROLINE ATOLLS. WOLEAI: Utagal I., July 1946, Oakley, on *Cocos nucifera.*

TRUK. TON (Tol): May 1946, Oakley, on lime. WENA (Moen): May 1946, Oakley, on *Cocos nucifera.*

PONAPE. Expt. Station near Colonia, Aug. 1946, Oakley, on orange leaves.

KUSAIE. Lele I. (Ruins), Mar. 1953, Clarke, on *Nipa fruticans.*

WAKE. Feb. 1939, Bianchi, on coconut palm from Guam; Nov. 1953, Davidson, on unidentified leaves; Nov. 1959, Ford, on coconut leaf.

MARSHALL IS. KWAJALEIN: Aug. 1946, Oakley, on *Cocos nucifera*; Dec. 1947, Maehler, on *Cocos nucifera*; Nov. 1952, Krauss, on coconut leaves. LIB: Lib I., Oct. 1952, Beardsley, on coconut leaf. AILINGLAPALAP: Ailinglapalap I., Aug. 1946, Oakley, on *Artocarpus altilis* and *Cocos nucifera.* JALUIT: Mejetto I. (?), Aug. 1946, Oakley, on *Cocos nucifera.* MAJURO: Telap (Delap) I., Aug. 1946, Oakley, on *Cocos nucifera*; Majuro I., Aug. 1946, Oakley, on banana and *Cocos nucifera*; Majuro I., May 1958, Owen, on coconut leaf.

HOSTS: This species has been most commonly collected on citrus and coconut foliage, but has also been taken on breadfruit, banana, and several ornamentals and uncultivated trees in Micronesia.

87. Aonidiella orientalis (Newstead).

Aspidiotus orientalis Newstead, 1894, Indian Mus. Notes **4**: 4.

Chrysomphalus pedroniformis Cockerell and Robinson, 1915, Am. Mus. Nat. Hist., Bull. **34**: 107, fig. 8.

Aonidiella orientalis: McKenzie, 1937, Microent. **3** (1): 12, fig. 12.

DISTRIBUTION: India (type locality), Philippines, North Africa, Australia, North and South America, Micronesia.

S. MARIANA IS. SAIPAN: Tanapag Harbor, June 1946, Townes and Fosberg, on *Bruguiera sexangulata.* TINIAN: June 1946, Oakley, on *Ricinus.* ROTA: Aug. 1946, Townes, on *Agave sisalana.* GUAM: Piti, July 1936, Swezey, on rose; Oct. 1953, Liming, on *Nerium oleander* and *Plumeria.*

YAP. YAP: Kolonia (Yaptown), July 1946, Townes, on *Rhizophora mucronata*; Kolonia, Mar. 1949, Maehler, on *Solanum melongena* and *Ricinus communis.*

HOSTS: In Micronesia this species has been taken only on eggplant, ornamentals and uncultivated plants. Merrill (1953: 15) lists it from a number of hosts including avocado, banana, guava, and mango.

Genus **Aspidiella** Leonardi

Aspidiella Leonardi, 1898, Riv. Path. Vegetale **6**: 210, 220 (not seen).—Ferris, 1938, Atlas Scale Ins. North America S-II : 187.

Type of genus: *Aspidiotus sacchari* Cockerell.

Key to Known Micronesian Species of Aspidiella (after Ferris, 1942)

Median lobes of pygidium each with a conspicuous elongate, somewhat clavate internal sclerosis extending anteriorly from its base; fringe plates absent anterior to third lobes; on grasses ..... **sacchari**

Median lobes without such strongly developed internal sclerosis extending from their bases; marginal fringe plates present anterior to third pygidial lobes; associated with yams ..... **hartii**

88. Aspidiella hartii (Cockerell).

Aspidiotus hartii Cockerell, 1895, Psyche **7**, suppl. 1 : 7.
Aspidiotus (*Aspidiella*) *hartii:* Leonardi, 1898, Riv. Path. Vegetale **6** : 277.
Aspidiella hartii: Ferris, 1938, Atlas Scale Ins. North America S-II : 188.

DISTRIBUTION: West Indies (type locality: Trinidad), Micronesia (Guam?).

Fullaway (1946 : 161) recorded this species from Guam on *Dioscorea* sp. I have seen no specimens from Micronesia.

HOSTS: Yams (*Dioscorea* spp.).

89. Aspidiella sacchari (Cockerell).

Aspidiotus sacchari Cockerell, 1893, Inst. Jamaica, Jour. **1** : 255.
Aspidiotus (*Aspidiella*) *sacchari:* Leonardi, 1898, Riv. Path. Vegetale **6** : 210.
Aspidiella sacchari: Ferris, 1938, Atlas Scale Ins. North America S-II : 189.

DISTRIBUTION: West Indies (type locality: Jamaica), South America, Florida, Ceylon, Micronesia.

S. MARIANA IS. Saipan: Sept. 1956, McDaniel, on thick-stemmed grass. Tinian: Camp Chuco, June 1946, Oakley, on Napier grass. Guam: Dec. 1911, Fullaway; Piti, June 1911, Fullaway, on grass; Piti, May 1936, Usinger, on grass (*Sporobolus* ?); Machanao, June 1936, Swezey, on Guatemala grass; Agat, July 1938, Oakley, on sugar cane.

PALAU. Babelthuap: July 1946, Oakley, on Jobs tears.

MARSHALL IS. Kwajalein: Kwajalein I., Oct. 1953, Beardsley, on Bermuda grass.

HOSTS: Various grasses including sugar cane.

Genus **Aspidiotus** Bouché

Aspidiotus Bouché, 1833, Naturgeschichte der Schädlichen und Nützlichen Garteninsecten, 32 (not seen).—Ferris, 1941, Microent. **6** (2) : 33.
Temnaspidiotus McGillivray, 1921, The Coccidae, 403.

Type of genus: *Aspidiotus nerii* Bouché (= *Chermes hederae* Vallot).

Key to Species of Aspidiotus Known From Micronesia

1. Median lobes of pygidium each with a broad sclerosis extending anteriorly; anal opening very small, located close to basal scleroses of median lobes, only slightly more than length of one median lobe anterior to bases of lobes..... **spinosus**
   Without such basal scleroses extending anteriorly from bases of median lobes of pygidium; anal opening larger, its distance from bases of lobes two or more times length of one lobe..... 2
2. Tubular ducts of pygidium relatively short, about 35 μ maximum length, some on lateral parts of pygidium opening as far forward as anterior end of posterior group of perivulvar pores; pygidium strongly excised at apex, so that medial lobes appear recessed and do not extend posteriorly as far as apex of second lobes... **excisus**
   Tubular ducts of pygidium longer, up to about 100 μ in length, none located as far forward as hind margin of posterior group of perivulvar pores; median lobes less noticeably recessed, usually extending posteriorly past apex of second lobes..... **destructor**

90. Aspidiotus destructor Signoret.

Aspidiotus destructor Signoret, 1869, Soc. Ent. France, Ann. IV, **9** : 120, pl. 3, figs. 8, 8a.—Ferris, 1941, Microent. **6** (2) : 51, fig. 19.
See Ferris (1941 : 51) for listing of synonymy.

DISTRIBUTION: Found throughout most tropical areas of the world (type locality: Reunion I.). Apparently not yet established in the Marshall Is.

S. MARIANA IS. Saipan: June 1946, Oakley, on breadfruit; Afetna Point, June 1946, Townes, on *Hernandia*; Tanapag Harbor, July 1946, Townes, on *Areca catechu*; June 1947, Langford, on *Artocarpus*; Susupe, Jan. 1948, Maehler, on breadfruit; Jan. 1949, Maehler, on *Artocarpus communis*; Magicienne Bay, Feb. 1949, Maehler, on *Barringtonia*; Aug. 1951, R. M. Bohart, on papaya; Oleai, Feb. 1957, Krauss, on breadfruit leaves; Oct. 1960, U.S. Navy, on breadfruit leaves. Tinian: Marpo Valley, June 1946, Oakley, on breadfruit. Agiguan: June 1952, Peterson, on young coconut tree. Rota: Sabana, June 1946, Townes, on *Hernandia*; Marpo Valley, June 1951, R. M. Bohart, on papaya. Guam: Sinajana, 1936, Swezey, on banana; Yigo, Nov. 1936, Swezey, on banana, coconut, and avocado; Yigo, July 1938, Oakley, on avocado; Talofofo, Dec. 1947, Maehler, on cassava; Agana, May 1948, Maehler, on breadfruit; Agana, Aug. 1952, Krauss, on breadfruit; Nov. 1953, Liming, on avocado; Jan. 1954, Liming,

on *Euphorbia pulcherrima* leaves; Santa Rita, May 1960, F. Riberto, on leaves of banana, mango, and betelnut.

PALAU. BABELTHUAP: July 1946, Oakley, on coconuts. KOROR: July 1946, Oakley, on *Pandanus tectorius*; Mar. 1948, Maehler, on *Psidium guajava*; July 1953, Beardsley, on papaya leaf; Jan. 1954, Beardsley, on *Euphorbia pulcherrima* leaves. NGESEBUS: Aug. 1958, Owen, on *Ficus* leaf. PELELIU: July 1946, Oakley, on *Artocarpus altilis*.

YAP. YAP: July 1946, Oakley, on *Areca catechu*; Kolonia, Mar. 1949, Maehler, on *Artocarpus altilis*; Central Yap, Aug. 1950, Goss, on *Artocarpus altilis*; Oct. 1952, Krauss, on banana leaf; May 1958, Tellei on coconut leaves. RUMUNG: Apr. 1950, Langford, on breadfruit leaves.

TRUK. WENA (Moen): May 1946, Townes, on *Nipa fruticans* and *Sonneratia caseolaris*; July 1946, Oakley, on *Phoenix canariensis*; Feb. 1948, Maehler, on banana; Civ. Ad. Area, Mar. 1949, Potts, on breadfruit; Oct. 1952, Beardsley, on coconut leaves and papaya leaves. TONOAS (Dublon): May 1946, Oakley, on *Artocarpus altilis*; Feb. 1948, Maehler, on breadfruit. TON (Tol): May 1946, Townes, on banana and papaya. FEFAN: May 1946, Oakley, on *Artocarpus altilis*. UDOT: May 1946, Townes, on *Artocarpus altilis*.

PONAPE. Colonia, Expt. Station, Aug. 1946, Oakley, on cashew; Nov. 1948, Maehler, on coconut; Madolenihm Plantation, Dec. 1948, Langford, on coconut; Colonia, Jan. 1949, Ross, on *Anacardium occidentale*; Madolenihm Plantation, Jan. 1949, Ross, on breadfruit, coconut, *Ceiba pentandra*, and mango.

HOSTS: Recorded from a variety of hosts throughout its range. In Micronesia it is a pest of coconut, breadfruit, mango, papaya, banana, betel palm, and various ornamental and wild plants. This species is one of the most important crop pests among the armored scales. Takahashi (1936–1942) recorded *A. destructor* from Saipan, Rota, Yap, Palau, Ponape, and Woleai Atoll, on various host plants.

Most of the Micronesian specimens at hand agree well with Ferris' (1941) redescription and figure of this species. Specimens from a few collections have the median pygidial lobes somewhat broader than indicated by Ferris, the space between them being distinctly less than the width of one. Otherwise, these specimens are not materially different from Ferris' concept of *A. destructor*. Since there is a nearly continuous range of variation between the smallest and largest median lobes in the specimens examined during this study, all are placed here as *A. destructor*.

91. Aspidiotus excisus Green.

Aspidiotus excisus Green, 1896, Coccidae of Ceylon, pt. 1 : 53, pl. 10, figs. 7010.—Ferris, 1941, Microent. **6** (2) : 53, fig. 20.

Temnaspidiotus excisus: MacGillivray, 1921, The Coccidae, 403.

DISTRIBUTION: Ceylon (type locality), Formosa, Fiji, Micronesia.

S. MARIANA IS. SAIPAN: June 1946, Townes, on papaya. TINIAN: Lake Hagoi (Hagoya), June 1946, Oakley, on papaya fruit.

PALAU. NGERKABESANG: Aug. 1953, Beardsley, on citrus leaves.

CAROLINE ATOLLS. ULITHI: Falalop I., Apr. 1954, Beardsley, on breadfruit leaf; Asor I., Jan. 1964, Owen, on papaya. EAURIPIK: Eauripik I., Jan. 1964, Owen, on banana. FARAULEP: Faraulep I., Jan. 1964, Owen, on breadfruit leaves. WOLEAI: Woleai I., Jan. 1964, Owen, on breadfruit leaves; Utegal I., Jan. 1964, Owen, on banana. NUKUORO: Nukuoro I., Aug. 1946, Oakley, on papaya; Shenukdei I., Aug. 1946, Townes, on *Thespesia populnea*.

HOSTS: Taken on banana, citrus, breadfruit, papaya, and *Thespesia* in Micronesia. Takahashi (1941, 1942) reported this species from Yap and Palau on coconut and *Tournefortia*.

This is the type species of *Temnaspidiotus* MacGillivray. I have followed Ferris (1941) and do not consider the species is sufficiently distinct to warrant separation from *Aspidiotus*.

92. Aspidiotus spinosus Comstock.

Aspidiotus spinosus Comstock, 1883, Dept. Ent. Cornell Univ., Rept. **2**: 70.—Ferris, 1941, Microent. **6** (2): 58, fig. 20.—Zimmerman, 1948, Insects of Hawaii **5**: 355, fig. 180.

Aspididstus (sic) *persearum* Cockerell, 1898, The Entomologist **31**: 240.

DISTRIBUTION: Widespread (type locality: Washington, D.C.).

YAP. YAP: July 1956, McDaniel, on mango tree.

HOSTS: In the Hawaiian Islands, this species is common on avocado and I have taken it also on mango bark on Oahu. McKenzie (1956: 51) records it from a number of hosts.

Genus **Chrysomphalus** Ashmead

Chrysomphalus Ashmead, 1880, Am. Entomologist **3**: 268.—McKenzie, 1939, Microent. **4** (2): 51.

Type of genus: *Chrysomphalus ficus* Ashmead.

McKenzie (1939) has revised this genus, providing redescriptions and figures of the known species.

KEY TO KNOWN MICRONESIAN SPECIES OF CHRYSOMPHALUS

Second abdominal segment with a submarginal dorsal cluster of ducts; fringe plates anterior to third pygidial lobes without conspicuous clavate processes..... **ficus**

Second abdominal segment without such a cluster of submarginal ducts; first 2 fringe plates anterior to third pygidial lobes each bearing a conspicuous clavate process ..... **dictyospermi**

93. Chrysomphalus dictyospermi (Morgan).

Aspidiotus dictyospermi Morgan, 1889, Ent. Mo. Mag. **25**: 352, pl. V, fig. 2.

Aspidiotus mangiferae Cockerell, 1893, Inst. Jamaica, Jour. **1**: 255 (not seen).

Chrysomphalus minor Berlese and Leonardi, 1896, Riv. Path. Vegetale **4**: 346.

Chrysomphalus dictyospermi: Fernald, 1903, Cat. Coccidae of World, 289.—McKenzie, 1939, Microent. **4** (2): 57, fig. 29.—Zimmerman, 1948, Insects of Hawaii **5**: 369, fig. 190.

DISTRIBUTION: Widespread (type locality: British Guiana).

BONIN IS. No locality, host, or date, Kuwana collector.

S. MARIANA IS. SAIPAN: Near Tanapag Harbor, July 1946, Townes, on *Areca catechu.* GUAM: in quarantine at Honolulu, Woolford, on betel palm.

PALAU. KOROR: July 1953, Beardsley, on rose twigs; Aug. 1953, Beardsley, on guava leaves; on *Artocarpus integer* (= *A. heterophyllus*) and mango, reported by Takahashi (1939).

TRUK. WENA (Moen): May 1946, Townes, on *Sonneratia caseolaris.*

MARSHALL IS. MAJURO: Majuro I., Aug. 1946, Oakley, on lime; Majuro I., May 1958, Owen, on *Plumeria.*

HOSTS: Recorded from a variety of hosts including mango, citrus, jackfruit, and various palms.

94. Chrysomphalus ficus Ashmead.

Chrysomphalus ficus Ashmead, 1880, Am. Entomologist **3**: 267.—McKenzie, 1939, Microent. **4** (2): 59, fig. 30.—Zimmerman, 1948, Insects of Hawaii **5**: 369, fig. 191.

Chrysomphalus aonidum: Cockerell, 1899, Acad. Nat. Sci. Philadelphia, Proc. for 1899, 273.

DISTRIBUTION: Widespread (type locality: Florida).

BONIN IS. Kuwana (1909: 160) lists this species from Bonin Is.

PONAPE. Experiment Station near Colonia, Aug. 1946, Oakley, on orange leaves; Colonia, Jan. 1949, Ross, on *Citrus paradisi.*

HOSTS: Recorded from a variety of hosts including citrus, coconut, breadfruit, and mango.

See McKenzie (1939: 59) for discussion of nomenclatural problems involving this species, and for redescription and figure.

Genus **Duplaspidiotus** MacGillivray

Duplaspidiotus MacGillivray, 1921, The Coccidae, 394.—Ferris, 1938, Atlas Scale Ins. North America S-II : 226.
Lattaspidiotus MacGillivray, 1921, The Coccidae, 394.

Type of genus: *Pseudaonidia clavigera* Cockerell.

Key to Micronesian Species of Duplaspidiotus

Perivulvar pores present.....**claviger**
Perivulvar pores absent.....**tesseratus**

95. Duplaspidiotus claviger (Cockerell).

Pseudaonidia clavigera Cockerell, 1901, The Entomologist **34** : 226.
Duplaspidiotus claviger: MacGillivray, 1921, The Coccidae, 394.—Zimmerman, 1948, Insects of Hawaii **5** : 352, fig. 177.

DISTRIBUTION: Widespread (type locality: Durban, South Africa).
S. MARIANA IS. Guam: Oct. 1953, Liming, on *Gardenia*; Jan. 1954, Liming, on *Gardenia jasminoides*.
HOSTS: In Micronesia recorded only from *Gardenia*. Reported from *Citrus*, mango, *Hibiscus* and several other hosts elsewhere.

96. Duplaspidiotus tesseratus (de Charmoy).

Aspidiotus (*Diaspidiotus*) *tesseratus* de Charmoy, 1899, Soc. Amicale Scientifique, Proc., 23 (not seen).
Lattaspidiotus tesseratus: MacGillivray, 1921, The Coccidae, 458.
Duplaspidiotus tesseratus: Ferris, 1938, Atlas Scale Ins. North America S-II : 227.—Zimmerman, 1948, Insects of Hawaii **5** : 352, fig. 178.

DISTRIBUTION: Widespread (type locality: Mauritius), Micronesia?
S. MARIANA IS. Guam: Fullaway (1946 : 162) reports collecting this species from Guam on coffee. There are no specimens in the Micronesian material at hand.

Genus **Furcaspis** Lindinger

Furcaspis Lindinger, 1908, Berliner Ent. Zeitschr. **52** : 99.—Ferris, 1938, Atlas Scale Ins. North America S-II : 230.
Neofurcaspis Green, 1926, Bull. Ent. Research **17** : 62, new synonym.

Type of genus: *Aspidiotus biformis* Cockerell.
Green differentiated his *Neofurcaspis* (type of genus: *N. andamanensis* Green) from *Furcaspis* solely on the basis of the presence of a double row

of perivulvar pores in the type species. Inasmuch as the species found in Micronesia, *F. oceanica* Lindinger, lacks perivulvar pores although it is otherwise quite similar to *N. andamanensis*, there seems to be no basis for maintaining Green's genus.

97. Furcaspis oceanica Lindinger.

Furcaspis oceanica Lindinger, 1909, Zeitschr. Wiss. Insekt. **5**: 149.
Aspidiotus oceanica: Green, 1910, Jour. Economic Biol. **5** (1): 1, pl. 1, figs. 1–7.
Spinaspidiotus oceanicus: MacGillivray, 1921, The Coccidae, 430.
Chrysomphalus saipanensis Sasaki, 1935, Nippon Plant Protect. Soc., Jour. Plant Protect. (Byochugai Zasshi) **22**: 864–867 (in Japanese, not seen; synonymy according to Takahashi, 1939: 271).

DISTRIBUTION: Micronesia (type locality: Jaluit, Marshall Is.).

S. MARIANA IS. SAIPAN: USCC (U.S. Commercial Co.) Farm, June 1946, Oakley, on coconut; June 1947, Langford, on coconut; Garapan, Jan. 1948, Maehler, on coconut; Civ. Ad. Area, Jan. 1948, Maehler.

PALAU. BABELTHUAP: Ngiwal-Ngarard, Feb. 1958, on *Nipa fruticans*, Esaki; Ulimang, Dec. 1947, Dybas, on coconut fronds. KOROR: July 1946, Oakley, on coconut; Apr. 1953, Beardsley, on coconut leaves. PELELIU: July 1946, Townes, on coconut. ANGAUR: Dec. 1949, Owen, on coconut.

YAP. YAP: Dugor, Mar. 1949, Maehler, on *Nipa fruticans*; Aug. 1950, Goss, on coconut.

CAROLINE ATOLLS. ULITHI: Fassarai I., July 1946, Townes and Oakley, on coconut. WOLEAI: Falalis I., June 1958, Tellei, on coconut leaf; Utegal I., July 1946, Townes and Oakley, on coconut. IFALIK: Aug. 1953, Bates, on coconut leaf. SATAWAL: Sept. 1952, Krauss, on coconut. NOMWIN: May 1946, Oakley, on coconut and pandanus. NAMA: Oct. 1952, Beardsley, on *Pandanus*. LOSAP: Losap I., Oct. 1952, Beardsley, on *Pandanus*; Pis I., Oct. 1952, Beardsley, on coconut. MOKIL: July 1949, Owen, on coconut; Jan. 1953, Gressitt. PINGELAP: July 1949, Owen, on coconut; Jan. 1953, Gressitt, on coconut.

TRUK. WENA (Moen): May 1946, Oakley, on coconut; Feb. 1948, Maehler, on coconut; Jan. 1949, Ross, on coconut; Oct. 1952, Beardsley, on coconut leaves. TONOAS (Dublon): Feb. 1948, Maehler, on coconut. TON (Tol): Mt. Unibot, Dec. 1952, Gressitt, on native *Exorrhiza* palm; Mt. Unibot, Jan. 1953, Gressitt, on small *Pandanus*. FEFAN: May 1946, Oakley, on coconut.

PONAPE. Mt. Dolen Nankep, Aug. 1946, Townes, on *Exorrhiza ponapensis*; Colonia, Aug. 1946, Oakley, on coconut; Madolenihm (Metalanum) Plantation, Dec. 1948, Maehler; Colonia, Jan. 1949, Ross, on coconut; Madolenihm Plantation, July 1949, Owen, on coconut; Expt. Station (near

Colonia), July 1950, Adams; Mt. Temwetemwensekir (Tamatamansakir), July 1950, Adams.

KUSAIE. Lele I., Aug. 1946, Oakley, on coconut; south slope Mt. Matante, 270 m., Feb. 1953, Clarke, on *Ponapea ledermanniana*; Malem, Feb. 1953, Clarke, on *Cocos nucifera*; Mutunlik, Mar. 1953, Clarke, on coconut; Lele I., (ruins), Mar. 1953, Clarke, on *Nipa fruticans*; Mt. Wakapp, 210 m., April 1953, Clarke, on *Ponapea* sp.

MARSHALL IS. KWAJALEIN: Aug. 1946, Oakley, on coconut. LIB: Oct. 1953, Beardsley, on coconut petiole. AILINGLAPALAP: 1910, Cooley, on coconut; Bikajela I., Aug. 1946, Oakley, on coconut. JALUIT: Imroj I., Aug. 1946, Oakley, on coconut; Jabor I., Aug. 1946, Oakley, on coconut; Mejetto (Medyado) I., Aug. 1946, Oakley, on coconut; Mejetto I., May 1958, Gressitt, on coconut leaf. LIKIEP: Likiep I., Aug. 1946, Oakley, on coconut. MAJURO: Majuro I., Aug. 1946, Oakley, on coconut; Telap (Dalap) I., Aug. 1946, Oakley, on coconut; Uliga I., June 1950, La Rivers, on coconut. ARNO: June 1950, Usinger, on coconut; Aug. 1950, La Rivers, on coconut.

HOSTS: Coconut, *Nipa*, various native palms, and *Pandanus*. This species is possibly native to Micronesia. It developed into a serious pest of coconut when accidentally introduced into Saipan, N. Mariana Is. Takahashi (1939, 1942) reported this species from Palau, Truk, Ponape, Kusaie, and Wotje and Jaluit Atolls in the Marshalls, from coconut, *Nipa* palm, *Pandanus*, and *Bentnickiopsis ponapensis* (now *Exorrhiza*).

Takahashi (1939) has pointed out that *F. oceanica* is closely allied to *F. andamanensis* (Green), described from coconut from the Andaman Islands in the Indian Ocean (see Ferris, 1938, for figure of *F. andamanensis*). I have examined specimens from the type lot of *F. andamanensis* in the U.S. National Coccid Collection in Washington, D.C. Both these species possess groups of lateral gland tubercles on the prosoma and very long submarginal setae on the anterior portions of the body. *F. andamanensis* differs in possessing numerous widely scattered perivulvar disc pores and in having much shorter pygidial paraphyses. *Furcaspis hematochroa* Cockerell from the Philippine Islands also is closely allied to *F. oceanica* and *F. andamanensis*. *F. hematochroa* specimens possess perivulvar pores as in the latter, and in addition have a single very long seta on the pygidial margin on abdominal segment five. Both *andamanensis* and *hematochroa* possess a single slender apically bifurcate plate on the margin of the pygidium anterior to the third lobe which is not present in *oceanica*. Laing (1929 : 26) states that *F. cladii* Maskell from Australia is also similar but I have not seen specimens of that species.

Genus **Hemiberlesia** Leonardi

Hemiberlesia Leonardi, 1897, Riv. Path. Vegetale **6**: 105.—Ferris, 1938, Atlas Scale Ins. North America S-II : 232.

Type of genus: *Aspidiotus rapax* Comstock.

Key to Recorded Micronesian Species of Hemiberlesia

1. Apex of pygidium with a band of broad apically fringed plates of nearly uniform length extending to site of obsolete fourth pygidial lobe in a dense, nearly uniform fringe.....**palmae**
   Apex of pygidium with band of fringe plates less strongly developed, plates anterior to site of third lobe of reduced size, not forming such a dense uniform fringe..... 2
2. Second and third pygidial lobes reduced to small unsclerotized points; female scale circular, convex..... 3
   Second lobes well developed, sclerotized; third lobes sclerotized and distinct; female scale flat, elongate-oval.....**cyanophylli**
3. Perivulvar pores present.....**lataniae**
   Perivulvar pores absent.....**rapax**

98. Hemiberlesia cyanophylli (Signoret).

Aspidiotus cyanophylli Signoret, 1869, Soc. Ent. France, Ann. IV, **9**: 119.
Furcaspis cyanophylli: MacGillivray, 1921, The Coccidae, 407.
Hemiberlesia cyanophylli: Ferris, 1938, Atlas Scale Ins. North America S-II : 237.—Zimmerman, 1948, Insects of Hawaii **5**: 358, fig. 182.

DISTRIBUTION: Widespread (type locality: France).

MARSHALL IS. Kwajalein: In quarantine at Guam, Mar. 1952, on unidentified leaves. Ailinglapalap: Ailinglapalap I., Aug. 1946, Oakley, on *Artocarpus altilis*.

HOSTS: Recorded elsewhere from a wide variety of hosts including avocado, banana, mango, and sugar cane. Breadfruit (*Artocarpus altilis*) is the only host record from Micronesia.

99. Hemiberlesia lataniae (Signoret).

Aspidiotus lataniae Signoret, 1869, Soc. Ent. France, Ann IV, **9**: 124.
Aspidiotus cydoniae Comstock, 1881, U.S. Dept. Agric., Rept. for 1880, 295.—Kuwana, 1909, New York Ent. Soc., Jour. **17**: 160.
Hemiberlesia lataniae: Ferris, 1938, Atlas Scale Ins. North America S-II : 241.—Zimmerman, 1948, Insects of Hawaii **5**: 361, fig. 183.
See McKenzie (1956 : 69) for more complete synonymy.

DISTRIBUTION: Widespread (type locality: presumably France).

BONIN IS. Listed by Kuwana (1909 : 160) as *Aspidiotus cydoniae.* Specimens from Kuwana's Bonin Islands material, without date or specific locality record, have been examined during this study.

VOLCANO IS. Iwo Jima: July 1958, Owen, on leaves and fruit of *Morinda*.

S. MARIANA IS. Saipan: Afetna Point, June 1946, Townes, on *Barringtonia asiatica*; Magpi (Marpi) Point; June 1946, Townes, on *Abrus precatorius*. Guam: Forest near Tumon Beach, Mar. 1918, Weston, on *Annona reticulata* rind; Agana, Mar. 1911, Weston, on avocado leaf.

PALAU. Koror: Mar. 1948, Maehler, on *Leucaena glauca*; Aug. 1958, Tellei, on coconut leaves and flowers.

YAP. Yap: Kolonia, Mar. 1949, Maehler, on mango.

TRUK. Wena (Moen): May 1946, Townes, on *Indigofera hirsuta*; Feb. 1954, Beardsley, on breadfruit bark. Tonoas (Dublon): May 1946, Oakley, on orange. Udot: May 1946, Oakley, on bitter-sweet orange.

PONAPE. Madolenihm (Metalanum) Plantation, Aug. 1946, Oakley, on orange; Expt. Station near Colonia, Mar. 1948, Dybas, on *Hyophorbe verschaffeltii*.

KUSAIE. In quarantine at Honolulu, Sept. 1952, Ross, on *Citrus sinensis*.

WAKE. Nov. 1959, Ford, on *Ficus edulis* leaf.

MARSHALL IS. Kwajalein: Aug. 1946, Oakley, on *Morinda citrifolia*. Lib: Lib. I., Oct. 1953, Beardsley, on coconut leaf, and *Plumeria* leaves. Majuro: Majuro I., Aug. 1946, Oakley, on lime.

GILBERT IS. Tarawa: Banraeaba I., Dec. 1957, Krauss, on fruit of mangrove, probably *Rhizophora*.

HOSTS: Recorded from a variety of hosts. In Micronesia it has been taken on avocado, breadfruit, *Citrus*, coconut, mango, and various ornamentals and wild plants. Takahashi (1936–1942) recorded *H. lataniae* from Pagan, Saipan, Yap, and Truk, on avocado, *Barringtonia*, *Casuarina*, *Citrus*, and coconut.

100. Hemiberlesia palmae (Cockerell).

Aspidiotus palmae Cockerell, 1893, Ent. Mo. Mag. **29** : 39.

Furcaspis palmae: MacGillivray, 1921, The Coccidae, 407.

Aspidiotus jaranensis Kuwana, 1931, Dobutsubaku Zasshi **43** : 647.

Hemiberlesia palmae: Ferris, 1938, Atlas Scale Ins. North America S-II : 242.

DISTRIBUTION: Widespread (type locality: Jamaica).

S. MARIANA IS. Saipan: In quarantine at Hawaii, Apr. 1949, Wallace, on legume.

PALAU. Babelthuap: July 1946, breadfruit, Oakley; Ngerehelong, Dec. 1947, Dybas; Ulimang, Dec. 1947, Dybas, beating dead banana leaves. Koror: Jan. 1954, Beardsley, on leaves of *Jatropha multifida*; Aug. 1958, Owen, on coconut leaf. Ulebsehel (Auluptagel): July 1958, Owen, on *Intsia bijuga* leaves.

YAP. YAP: July 1946, Oakley, on citrus; Kolonia, Dec. 1963, Owen, on avocado leaves.

PONAPE. Colonia-Jokaji, Nov. 1937, Esaki, on *Cycas*; Colonia, Aug. 1946, Oakley, on avocado and breadfruit; Colonia, Aug. 1946, Townes, on *Terminalia catappa*; Kiti, Aug. 1946, Oakley, on mango; Madolenihm (Metalanim) Plantation, Jan. 1949, Ross, on *Ceiba pentandra*, July 1949, Owen, on coconut.

KUSAIE. Lele I., Aug. 1946, Oakley, on breadfruit; Lele (Lelu) I., Mar. 1953, Clarke, on *Nipa fruticans*; Hill 541, 70 m., Mar. 1953, Clarke, on breadfruit leaves.

HOSTS: Recorded from a variety of hosts. In Micronesia it has been collected from avocado, breadfruit, citrus, coconut, mango, and various ornamental and wild plants. Takahashi (1939–1941) recorded this species (as *A. jaranensis*) from Saipan, Palau, Truk, Ponape, and Wotje Atoll in the Marshalls, on avocado, betelnut, breadfruit, *Cycas* and *Terminalia*.

101. Hemiberlesia rapax (Comstock).

Aspidiotus rapax Comstock, 1881, U.S. Dept. Agric., Rept. for 1880, 307, fig.

Hemiberlesia rapax: Ferris, 1938, Atlas Scale Ins. North America S-II : 244.—Zimmerman, 1948, Insects of Hawaii **5** : 361, fig. 184.

See McKenzie (1956 : 73) for more complete synonymy.

DISTRIBUTION: Widespread (type locality: California and Florida).

BONIN IS.: Listed by Kuwana (1909 : 160) from the Bonin Is. from several hosts. The Micronesian material presently at hand does not include specimens of this species.

Genus **Melanaspis** Cockerell

Melanaspis Cockerell, 1897, U.S. Dept. Agric., Div. Ent., Tech. Ser. **6** : 9.—Ferris, 1941, Atlas Scale Ins. North America S-III : 347.

Type of genus: *Aspidiotus obscurus* Comstock.

See Ferris (1941 : 347) for detailed consideration of synonomy involving this genus.

102. Melanaspis bromeliae (Leonardi).

Aonidiella bromiliae Leonardi, 1899, Riv. Path. Vegetale **7** : 177.

Aspidiotus bromiliae: Newstead, 1901, Monogr. Brit. Coccidae **1** : 86, pl. III, figs. 1–5, pl. IV, fig. 2, pl. XI, fig. 6.

Chrysomphalus bromeliae: Fernald, 1903, Cat. Coccidae of World, 289.

Pseudishnaspis anassarum Lindinger, 1930, Deutschen Ent. Gesell., Mitt. **3** : 26.

Melanaspis smilacis: Ferris, 1941, Atlas Scale Ins. North America S-III : 366 (in part).—Balachowsky, 1958, Mus. Roy. Congo Belge (Zool.) Ann. **4** : 202, pl. 76 (in part).

DISTRIBUTION: Widespread (type locality: England, on pineapple from the Canary Is.).

S. MARIANA IS. GUAM: Merizo, Dec. 1957, LaPlante, on pineapple leaves.

PONAPE. Colonia, Nov. 1953, Beardsley, on dryland taro.

HOSTS: Commonly recorded from pineapple; taro.

Ferris (1941) considers *M. bromeliae* a synonym of *M. smilacis* (Comstock). In his opinion the latter is a variable species and *M. bromeliae* specimens fall within the range of this variation. During 1957, I examined the available specimens of both forms in the U.S. National Coccid Collection in Washington, D.C., and concluded that the two probably are distinct. The following differences were noted: In *M. bromeliae* the pygidium is definitely more acute and triangular, whereas in specimens of *M. smilacis* examined the apex of the pygidium is slightly rounded and there is a distinct lateral swelling on each side at the base of the pygidium (fifth abdominal segment). This lateral swelling is well illustrated in Ferris' figure of *M. smilacis*. The two long pygidial paraphyses on each side are noticeably shorter in *M. bromeliae* specimens that I have seen than in those of *M. smilacis*. In *M. bromeliae* the longest of these is only slightly longer than the median lobes; whereas the paraphyses of *M. smilacis* specimens examined are twice as long as the median lobes, or longer. In addition, the anal opening seems to be somewhat farther forward in *bromeliae* than in *smilacis*. This species has been adequately illustrated by Balachowsky (1958) under the name *M. smilacis* Comstock, form from pineapple.

Genus **Octaspidiotus** MacGillivray

Octaspidiotus MacGillivray, 1921, The Coccidae, 387.

Type of genus: *Aspidiotus subrubescens* Maskell.

103. Octaspidiotus araucariae Adachi and Fullaway.

Octaspidiotus araucariae Adachi and Fullaway, 1953, Hawaiian Ent. Soc., Proc. **15** (1) : 89, pl. 2.

DISTRIBUTION: Hawaii (type locality), New Caledonia, Caroline Is.

PONAPE. Colonia, Nov. 1953, Beardsley, on *Araucaria excelsa*.

HOSTS: Known only from *Araucaria*.

Genus **Pseudaonidia** Cockerell

Pseudaonidia Cockerell, 1897, U.S. Dept. Agric., Div. Ent., Tech. Ser. **6**: 14; Ferris, 1938, Atlas Scale Ins. North America S-II : 252.

Type of genus: *Aspidiotus duplex* Cockerell.

104. Pseudaonidia manilensis Robinson.

Pseudaonidia manilensis Robinson, 1918, Philippine Jour. Sci. **13** D (4): 146, fig. 2.

DISTRIBUTION: Philippine Is. (type locality: Manila), Caroline Is.

PALAU. BABELTHUAP: Imeliik, Aug. 1953, Beardsley, on *Campnosperma*. KOROR: Sept. 1953, Beardsley, on rose twigs; April 1954, Beardsley, on branches and twigs of *Glochidion* sp.

HOSTS: *Glochidion*, rose, *Campnosperma*.

The second and third pygidial lobes are very narrow and slender in this species, and are frequently broken off during the preparation of the slide mounts. The length of these lobes varies considerably in the specimens at hand, as in material studied by Robinson. In some specimens the apices of the lobes are acute; in others they are blunt or slightly expanded apically.

Genus **Semelaspidus** MacGillivray

Semelaspidus MacGillivray, 1921, The Coccidae, 393.—Williams, 1957, Roy. Ent. Soc. London, Proc. (ser. B) **26**: 33.
Paratargiona MacGillivray, 1921, The Coccidae, 394.

Type of genus: *Aspidiotus* (*Chrysomphalus*) *cistuloides* Green (= *Aspidiotus artocarpi* Green).

Williams (1957) has reviewed this genus, giving a key to the four included species, and figures of all except *S. mangiferae* Takahashi, which he did not see.

105. Semelaspidus mangiferae Takahashi.

Semelaspidus mangiferae Takahashi, 1939, Tenthredo **2**: 341, fig. 2.—Williams, 1957, Roy. Ent. Soc. London, Proc. (ser. B) **26**: 39.

DISTRIBUTION: Philippine Is. (type locality: from Philippine Is., in quarantine at Taiwan), Caroline Is. (Palau).

PALAU. KOROR: Nov. 1952, Beardsley, on leaves of *Ficus* sp.; July 1953, Beardsley, on mango leaves; Aug. 1958, Owen, on soursop leaves. ULEBSEHEL (Auluptagel): July 1958, Owen, on leaf of unknown tree.

HOSTS: This scale has been taken on mango, soursop, *Ficus* sp., and an unknown tree.

The Micronesian specimens at hand agree well with Takahashi's description and figure of *S. mangiferae*, and with specimens from Manila, Philippine Is., ex mango leaves, Mar. 1925, which are in the U.S. National Coccid Collection in Washington, D.C. The dorsal reticulation of the pygidium appears to be less noticeably developed than in the species figured by Williams. Otherwise, it seems closely allied to the three other forms which Williams has placed in *Semelaspidus*.

Tribe ODONASPIDINI

Genus **Odonaspis** Leonardi

Odonaspis Leonardi, 1897, Riv. Path. Vegetale **5**: 284.—Ferris, 1938, Atlas Scale Ins. North America S-II: 161.

Type of genus: *Aspidiotus secretus* Cockerell.

Key to Known Micronesian and Hawaiian Odonaspis

1. Perivulvar pores absent; apex of pygidium with a cluster of structures resembling elongate gland spines ..... **penicillata**
   Perivulvar pores present; apex of pygidium without such a cluster of gland-spinelike structures 2
2. Posterior spiracles without associated perispiracular disc pores ..... **secreta**
   Posterior spiracles each with a group of several perispiracular pores 3
3. With an anterior group of perivulvar pores extending transversely across venter in front of vulva 4
   With lateral groups of perivulvar pores only, anterior transverse group wanting (Hawaii) ..... **greenii**
4. Median pair of pygidial furrows each with a conspicuous clavate sclerotized process; marginal seta on each side of median lobe large, about 30 μ long, situated on inner margin of apex of median furrow ..... **morrisoni**
   Medial pygidial furrows without such a clavate sclerotized process; setae of median lobes smaller, situated well mesad of apex of median furrow 5
5. Dorsal tubular ducts relatively large, about 4 μ wide at inner apices; perivulvar pores less numerous, totaling around 100, arranged in 3 discrete groups (Hawaii) ..... **ruthae**
   Dorsal tubular ducts smaller, 2–3 μ wide at inner apices; perivulvar pores more numerous, totaling around 200 or more, lateral and anterior groups confluent ..... **saccharicaulis**

106. Odonaspis morrisoni Beardsley, n. sp. (fig. 32).

Female. Length of slide-mounted specimens 0.8–1.3 mm.; body usually somewhat longer than broad. Pygidium with fused median lobes forming a moderately protuberant, apically rounded projection, outer margin slightly serrate near base; pygidial margin with a marked indentation at posterior apex of groove separating abdominal segments 7 and 8; a conspicuous seta, about 30 μ long, on inner margin of indentation on each side. Each of median pair of pygidial grooves with a conspicuous dorsal sclerotic process extending from posterior margin anteriorly about 60 μ; these scleroses becoming wider anteriorly, clavate at their inner ends. Furrows between abdominal segments 4 to 5, 5 to 6 and 6 to 7 marked

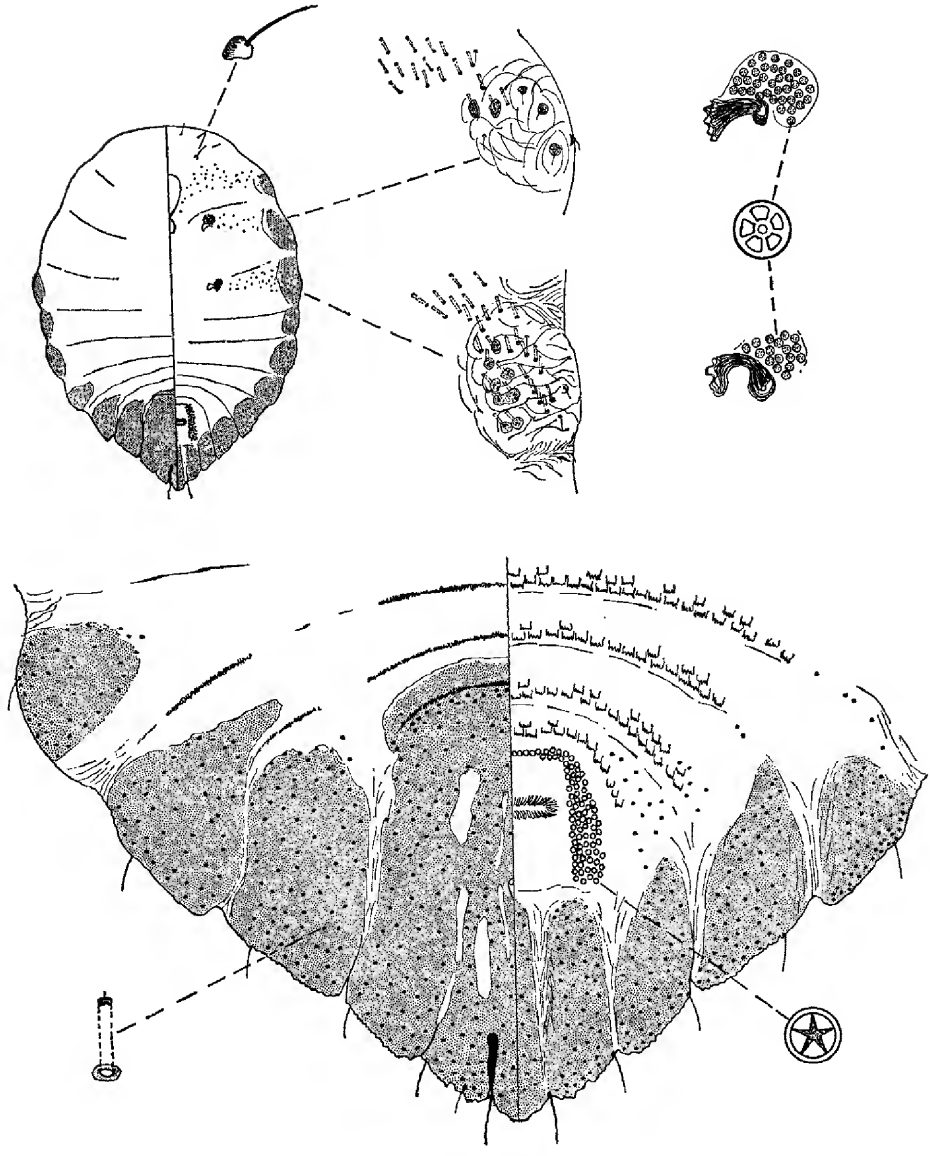

FIGURE 32.—*Odonaspis morrisoni*, adult female, dorsal and ventral aspects and details.

by similar indentations on pygidial margin, but lacking conspicuous scleroses of mesal pair of furrows; margin of pygidium serrate. Venter of pygidium with a mesal, elongate, narrowly triangular area of slightly heavier sclerotization extending from base of median lobes to a point directly beneath anal opening. Perivulvar pores numerous, about 150 to 200 in a continuous band on each side of and anterior to vulva; lateral bands 4 to 6 pores wide over most of their length; anterior band 1 or 2 pores wide at center. Perispiracular pores numerous, 30 to 50 associated with each anterior spiracle, 15 to 25 with each posterior spiracle. Tubular ducts numerous on both dorsum and venter of pygidium and on lateral margins of anterior abdominal segments. Lateral margins of venter of metathorax on each side with 5 to 10 small flattened sclerotized gland tubercles, 8 to 13 such gland tubercles on lateral margin of each side of mesothorax, these associated with additional tubular ducts not borne on sclerotized tubercles.

Holotype, female (BISHOP 6148) and 3 paratypes on one slide, Truk Is., Wena, Feb. 1954, Beardsley, on stems of tall grass. Five paratypes (US,UH) on 2 slides, same data as type slide; 4 paratypes (UH) on one slide, Tonoas (Dublon), Oct. 1952, Beardsley, on *Cynodon dactylon*; 4 paratypes (BISHOP, UH) on 2 slides, Yap Is., Yap, July 1956, McDaniel, on grass. Two paratypes (US) on one slide, Philippine Is., in quarantine at San Francisco, Apr. 1939, R. D. Clemens, on *Zoysia matrella*.

DISTRIBUTION: Philippine Is., Caroline Is. (Yap, Truk).

HOSTS: *Cynodon dactylon* (Bermuda grass), *Zoysia matrella* (Manila grass), and probably other grasses.

Odonaspis morrisoni appears allied to *O. greenii* Cockerell and *O. secreta* (Cockerell). Both the latter species possess dorsal scleroses in the pygidial furrows between abdominal segments 6 and 7, as well as between segments 7 and 8. The perispiracular pores are more numerous in *O. morrisoni* than in either *O. greenii* or *O. secreta*. *O. schizostachyi* Cockerell and Robinson is also similar, but has more numerous perivulvar pores, around 400 in specimens examined, and a broader ventral triangular thickening extending anteriorly from the base of the median lobe than does *O. morrisoni*.

This species is named in honor of the late Dr. Harold Morrison. Dr. Morrison's unpublished key to *Odonaspis* of the world greatly facilitated the comparison of this undescribed form with previously described species. The new species had been included by Dr. Morrison in his key on the basis of the Philippine Islands specimens which have been designated paratypes above.

107. Odonaspis penicillata Green.

Odonaspis penicillata Green, 1905, Bombay Nat. Hist. Soc., Jour. **16**: 344, fig.—Ferris, 1938, Atlas Scale Ins. North America S-II : 164.

DISTRIBUTION: Ceylon (type locality), Japan, Hawaii, North America, Caroline Is. (Palau).

PALAU. KOROR: June 1956, McDaniel, on "*Bambusa palauensis*."

HOSTS: Bamboo.

108. Odonaspis saccharicaulis (Zehntner).

Aspidiotus sacchari-caulis Zehntner, 1897, Meded. Proef. Suikerriet Oost-Java, n. s. (39) : 1, figs.—Van Deventer, 1906, Handboek Suikerriet-Cultuur Rietsuiker Fabricage, Java **2** : 229, pl. 30.

Aspidiotus secretus var. *saccharicaulis:* Cockerell, 1899, Acad. Nat. Sci. Philadelphia, Proc. for 1899 : 274.

Odonaspis secreta saccharicaulis: Fernald, 1903, Cat. Coccidae of World, 300.

Odonaspis saccharicaulis: Green and Laing, 1923, Bull. Ent. Research **14** : 129, fig. 8.—Balachowsky, 1953, Act. Sci. Indus. Ent. Appl. **1202** : 739, pl. 113.

DISTRIBUTION: Java (type locality), India, Philippine Is., Cuba, Madeira, Mauritius?, Caroline Is. (Palau).

PALAU. KOROR: June, July 1953, Beardsley, on stems of tall grass and on sugar cane stalk; July 1956, McDaniel, on grass.

HOSTS: Various large grasses including sugar cane. Reported as a pest of sugar cane in Java, the Philippines, and Cuba.

A colored plate illustrating the *in situ* appearance on sugar cane and details of this scale accompanies Zehntner's description, and is reproduced by Van Deventer (1906). More recently, Balachowsky (1953) redescribed and illustrated the species.

109. Odonaspis secreta (Cockerell).

Aspidiotus secretus Cockerell, 1896, Psyche **7**, Suppl. 1 : 20.

Odonaspis secreta: Fernald, 1903, Cat. Coccidae of World, 300.—Ferris, 1938, Atlas Scale Ins. North America S-II : 166.

DISTRIBUTION: Japan (type locality), United States, Bonin Is.?

BONIN IS. Kuwana (1909 : 160) lists this species from the Bonin Islands, but it is not represented in material from Micronesia which I have seen.

HOSTS: Various bamboos. Kuwana lists it from *Arundinaria sineoni.*

This species is closely allied to *O. greenii* (Cockerell) which occurs on bamboo in Hawaii, but has not yet been collected in Micronesia. *O. greenii* differs in having several disc pores associated with each posterior spiracle and in lacking the connecting transverse row of perivulvar pores anterior to the vulva.

TRIBE DIASPIDINI

Genus **Andaspis** MacGillivray

Andaspis MacGillivray, 1921, The Coccidae, 275.—Rao and Ferris, 1952, Microent. **17** (1) : 17.

Type of genus: *Lepidosaphes hawaiiensis* Maskell.

This genus is allied to *Lepidosaphes*. Rao and Ferris (1952) reviewed the genus and figured the species known to them.

110. Andaspis punicae (Laing).

Lepidosaphes punicae Laing, 1929, Ann. Mag. Nat. Hist. X, **4**: 500, fig. 28.
Andaspis punicae: Hall, 1946, Roy. Ent. Soc. London, Trans. **97**: 503.—Rao and Ferris, 1952, Microent. **17** (1): 21, fig. 19.

DISTRIBUTION: Africa (type locality: Tanganyika), Hawaii (?), S. Mariana Is., Caroline Is.

S. MARIANA IS. GUAM: Umatac, Dec. 1954, J. Maguadog, on eggplant.

PALAU. KOROR: Jan. 1953, Beardsley, on *Macaranga* sp. twigs. PELELIU: July 1946, Oakley, on *Artocarpus altilis*.

HOSTS: The type host is *Punica granatum*. It has been reported also from *Litchi chinensis* in addition to eggplant, breadfruit, and *Macaranga* listed above from Micronesia.

Genus **Aulacaspis** Cockerell

Aulacaspis Cockerell, 1893, Inst. Jamaica, Jour. **4**: 180.—Scott, 1952, Microent. **17** (2): 33.

Type of genus: *Aspidiotus rosae* Bouché.

Scott (1952) has redescribed and figured the known East Asian species of this genus.

KEY TO KNOWN MICRONESIAN SPECIES OF AULACASPIS

1. Median lobes recessed in an apical notch of pygidium, their apices about on a level of those of second lobes, long and slender in form, their inner margins parallel at base, divergent apically..... **rosae**
   Median lobes not recessed in an apical notch in pygidium, their apices extending posteriorly beyond those of second lobes, form less elongate, length never more than slightly greater than maximum width, not or but slightly divergent apically... 2
2. Median lobes parallel at bases, slightly divergent apically, outer portion of mesal margin finely serrate; posterior spiracles each with a small group of about 15 associated disc pores; anteromedian group of perivulvar pores containing around 20 or fewer pores; anterior margins of prosoma angulate, prosomal tubercles well developed..... **madiunensis**
   Median lobes with mesal borders parallel almost to apex, apical portion nearly truncate to slightly rounded, not serrate; posterior spiracles each with a much larger group of around 30 or more associated disc pores; anteromedian group of perivulvar pores containing 35 to 50 pores; anterior margins of prosoma rounded, prosomal tubercles not appreciably developed..... **tegalensis**

111. Aulacaspis madiunensis (Zehntner).

Chionaspis madiunensis Zehntner, 1898, Meded. Proef. Suikerriet Oost-Java, III, **6**: 1.
Aulacaspis madiunensis: Takahashi, 1940, Mushi **13**: 26.

DISTRIBUTION: Java (type locality), Queensland, Africa (Uganda), Taiwan ?, China ?, Caroline Is.

PALAU. KOROR: July 1953, Beardsley, on stems of tall grass; June 1956, McDaniel, on sugar cane.

YAP. YAP: July 1956, McDaniel, on sugar cane.

HOSTS: Large grasses including sugar cane.

Scott (1952 : 38, fig. 25) redescribed and illustrated this species on basis of material from China. His description and figure differ from Micronesian material at hand in having the fourth pygidial lobes more strongly developed, the median lobes more evenly rounded apically, and apparently without fine serration; and the second abdominal segment much more expanded laterally. The Micronesian specimens compare well with specimens in the U.S. National Coccid Collection from Sumatra which, according to the late Dr. Harold Morrison, were earlier compared with specimens from the type lot of *A. madiunensis*. It seems possible that the specimens from China studied by Scott represent another species.

112. Aulacaspis rosae (Bouché).

Aspidiotus rosae Bouché, 1834, Naturgeschichte der Inseckten, 14 (not seen).

Aulacaspis rosae: Cockerell, 1896, Bot. Dept. Jamaica, Bull. **3** : 259.—Ferris, 1937, Atlas Scale Ins. North America S-I : 10.—Scott, 1952, Microent. **17** (2) : 40, figs. 31, 32.

DISTRIBUTION: Widespread (type locality: Europe ?).

BONIN IS. CHICHI JIMA: Ogiura, May 1958, Mitchell, on raspberry petioles.

HOSTS: Various plants belonging to the Rosaceae, particularly rose, raspberry, and blackberry.

113. Aulacaspis tegalensis (Zehntner).

Chionaspis tegalensis Zehntner, 1898, Meded. Proef. Suikerriet Oost-Java III, **6** : 7.

Aulacaspis tegalensis: Ferris, 1921, Bull. Ent. Research **12** : 213, fig. 2, a-c.—Scott, 1952, Microent. **17** (2) : 40, fig. 34.

DISTRIBUTION: Java (type locality), Taiwan, Philippines, Mauritius, Reunion, Caroline Is. (Yap).

YAP. YAP: Kolonia, Mar. 1954, Beardsley, on stalks of sugar cane.

HOST: Sugar cane.

Scott (1952 : 40, fig. 34) redescribes and figures this species. Micronesian specimens agree well with Scott's concept of the species and with specimens in the U.S. National Coccid Collection from Java and the Philippine Is.

Genus **Diaspis** Costa

Diaspis Costa, 1828, Napoli dalla Tipografia Trani, 8 pp. (not seen).—Ferris, 1937, Atlas Scale Ins. North America S-I : 31.

Type of genus: *Diaspis calyptroides* Costa (= *Aspidiotus echinocacti* Bouché).

Key to Known Micronesian Species of Diaspis

Pygidium with 4 to 6 large ducts in a submarginal series extending parallel to margin on each side, plus 2 to 4 smaller ducts on mesal portion on each side..... **bromeliae**

Pygidium without such a submarginal series of large tubular ducts, with 2 large submarginal ducts on each side (1 above each of second and third lobes) plus relatively numerous smaller ducts arranged in 3 or 4 oblique series..... **boisduvalii**

114. Diaspis boisduvalii Signoret.

Diaspis boisduvalii Signoret, 1869, Soc. Ent. France, Ann. IV, **9** : 432, pl. 5, fig. 1 and 2.—Ferris, 1937, Atlas Scale Ins. North America S-I : 32.—Zimmerman, 1948, Insects of Hawaii **5** : 412, fig. 224.

DISTRIBUTION: Widespread (type locality: Europe, in glasshouse).

PALAU. Koror: Jan. 1954, Beardsley, on pineapple leaves.

HOSTS: Orchids, palms, pineapple, etc.

115. Diaspis bromeliae (Kerner).

Coccus bromeliae Kerner, 1778, Naturgeschichte des *Coccus bromeliae* oder des Ananasschildes, 20 (not seen).

Diaspis bromeliae: Signoret, 1869, Soc. Ent. France, Ann. IV, **9** : 434.—Ferris, 1937, Atlas Scale Ins. North America S-I : 33.—Zimmerman, 1948, Insects of Hawaii **5** : 413, fig. 225.

DISTRIBUTION: Widespread (type locality: France, on imported pineapple).

PONAPE. Madolenihm (Metalanum) Plantation, Dec. 1948, Langford, on pineapple.

HOST: Pineapple.

Genus **Fiorinia** Targioni-Tozzetti

Fiorinia Targioni-Tozzetti, 1868, Soc. Ital. Sci. Nat., Atti **11** : 755.—Signoret, 1869, Soc. Ent. France, Ann. IV, **9** : 449.—Ferris, 1937, Atlas Scale Ins. North America S-I : 54.

Type of genus: *Fiorinia pellucida* Targioni-Tozzetti (= *Diaspis fioriniae* Targioni-Tozzetti).

KEY TO MICRONESIAN SPECIES OF FIORINIA

1. Medial lobes of pygidium yoked basally by a narrow internal sclerosis; dorsum of pygidium with large macroducts; perivulvar pores present; antennal tubercles enlarged, moderately to greatly elongated on their mesal margins..... 2
   Medial lobes of pygidium not yoked together by an internal sclerosis at base; pygidium without large dorsal macroducts or perivulvar pores; antennae not appreciably enlarged, their mesal margins not elongated; on litchi leaves...**nephelii**
2. Pygidial margin with 4 or 5 large macroducts on each side plus several smaller ducts on margin anterior to these; on conifers.....**japonica ?**
   Pygidial margin with 3 or 4 large macroducts, without smaller marginal ducts anterior to these; on non-coniferous hosts.....**fioriniae**

116. Fiorinia fioriniae (Targioni-Tozzetti).

Diaspis fioriniae Targioni-Tozzetti, 1867, Soc. Ital. Sci. Nat., Mem. **3** (3) : 14.

Fiorinia pellucida Targioni-Tozzetti, 1868, Soc. Ital. Sci. Nat., Atti. **11** : 755.

Fiorinia fioriniae: Cockerell, 1893, Ent. Mo. Mag. **29** : 39.—Ferris, 1937, Atlas Scale Ins. North America S-I : 55.—Zimmerman, 1948, Insects of Hawaii **5** : 377, fig. 194.

DISTRIBUTION: Widespread (type locality: Europe), Bonin Is. ?

BONIN IS. ? Kuwana (1909 : 160) lists "*Fiorinia fioriniae* ?" from "*Artocarpus integrifolia* ?" from the Bonin Islands. There are no specimens of this species in Micronesian material which I have seen.

HOSTS: This scale has been taken on a wide variety of hosts. In Hawaii it is frequently found on avocado and on various palms.

117. Fiorinia nephelii Maskell.

Fiorinia nephelii Maskell, 1897, Ent. Mo. Mag. **33** : 242.—Zimmerman, 1948, Insects of Hawaii **5** : 377, fig. 195.

DISTRIBUTION: China, Taiwan, Queensland, Australia (type locality not specified), Hawaii, S. Mariana Is. (Saipan) ?

S. MARIANA IS. SAIPAN: Takahashi (1939 : 272) reported this species from Saipan on litchi. There are no specimens among the Micronesian material I have seen.

HOST: *Litchi chinensis.*

118. Fiorinia japonica Kuwana (?).

Fiorinia fioriniae japonica Kuwana, 1902, Calif. Acad. Sci., Proc. III, **3** : 97.

Fiorinia japonica Kuwana, 1925, Japan Imp. Quar. Service Tech. Bull. **3** : 5, pl. 3.—Ferris, 1942, Atlas Scale Ins. North America S-IV : 394.

DISTRIBUTION: Japan (type locality), Taiwan, Philippine Is., United States, Micronesia (?).

HOSTS: Various conifers.

A slide is at hand bearing two specimens, Bonin (Ogasawara) Is., Sept. 1905, Kuwana, on *Pinus luchuensis*. This was listed as "*Fiorinia* sp." by Kuwana (1909 : 160). The specimens agree fairly well with the concept of *F. japonica* presented by Ferris (1942) and by McKenzie (1956 : 111, fig. 76), but differ in having the antennal tubercles less noticeably elongated on their mesal margins than indicated by the authors cited above. However, this character may be variable, and these specimens have been placed tentatively as *F. japonica*.

Genus **Howardia** Berlese and Leonardi

Howardia Berlese and Leonardi, 1896, Riv. Path. Vegetale **4** : 374.—Ferris, 1937, Atlas Scale Ins. North America S-I : 64.

Type of genus: *Chionaspis* (?) *biclavis* Comstock.

119. Howardia biclavis (Comstock).

Chionaspis (?) *biclavis* Comstock, 1883, Agric. Expt. Sta., Dept. Ent. Cornell Univ. Rept. **2** : 98.

Howardia biclavis: Berlese and Leonardi, 1896, Riv. Path. Vegetale **4** : 348.—Ferris, 1937, Atlas Scale Ins. North America S-I : 65.—Zimmerman, 1948, Insects of Hawaii **5** : 410, fig. 222.

DISTRIBUTION: Widespread (type locality: Washington, D.C.).

BONIN IS. Sept. 1905, Kuwana, on *Terminalia catappa*, *Punica granatum*, *Photinia wrightiana*, and *Trachelospermum jasminoides*.

PALAU. BABELTHUAP: Aug. 1956, McDaniel. KOROR: July 1956, McDaniel, on vine.

TRUK. TON (Tol): Recorded by Takahashi (1942 : 355) from citrus.

HOSTS: Recorded from bark of a wide variety of woody plants.

Genus **Ischnaspis** Douglas

Ischnaspis Douglas, 1887, Ent. Mo. Mag. **24** : 21.—Ferris, 1937, Atlas Scale Ins. North America S-I : 66.

Type of genus: *Ischnaspis filiformis* Douglas [= *Mytilaspis longirostris* (Signoret)].

120. Ischnaspis longirostris (Signoret).

Mytilaspis longirostris Signoret, 1882, Soc. Ent. France, Bull. VI, **2** : 35.

Ischnaspis filiformis Douglas, 1887, Ent. Mo. Mag. **24** : 21.

Ischnaspis longirostris: Cockerell, 1896, Ill. State Lab. Nat. Hist. 4 : 336.—Ferris, 1937, Atlas Scale Ins. North America S-I : 67.—Zimmerman, 1948, Insects of Hawaii **5** : 404, fig. 219.

DISTRIBUTION: Widespread (type locality: Europe).

BONIN IS. HARA (?): July 1951, R. Bohart, on "gum or Bo-dai-ju."

S. MARIANA IS. SAIPAN: June 1946, Oakley, on coffee; Chalan Laulau, June 1946, Oakley, on *Psychotria marianensis*; Tanapag, Jan. 1949, Maehler, on coffee. GUAM: Piti, Mar. 1936, Swezey, on *Jasminum sambac*; Inarajan, Mar. 1948, Maehler, on *Nipa fruticans*.

PALAU. BABELTHUAP: Ulimang, Dec. 1947, Dybas, on *Areca* palm. KOROR: July 1953, Beardsley, on leaves of mango and *Acacia confusa*; Jan. 1954, Beardsley, on coconut leaves; July 1956, McDaniel, on palm and on *Casuarina*; Aug. 1956, McDaniel, on mango.

HOSTS: Recorded from a wide variety of hosts, including coconut, coffee, mango, various palms, and *Pandanus*.

Genus **Lepidosaphes** Shimer

Lepidosaphes Shimer, 1868, Am. Ent. Soc., Trans. **1** : 373.—Ferris, 1937, Atlas Scale Ins. North America S-I : 70.
Mytilaspis Signoret, 1868, Soc. Ent. France, Ann. IV, **8** : 841.

Type of genus: *Coccus conchiformis* Gmelin (= *Coccus ulmi* Linnaeus).

See Ferris (1937) for a discussion of nomenclatorial problems involving this genus.

KEY TO KNOWN MICRONESIAN SPECIES OF LEPIDOSAPHES

1. Dorsal tubular ducts of pygidium, except marginal macroducts, very small, diameter of tubes equal to those arising from marginal gland spines, about 2 μ; usually with an area of stronger sclerotization surrounding anal opening, extending posteriorly as a narrow median bar 2
   Dorsal tubular ducts of pygidium larger, diameter of tubes much greater than those arising from marginal gland spines; without such an area of stronger sclerotization surrounding anal opening 6
2. Gland tubercles present on lateral margins of abdominal segments 1 to 3; pygidium with 5 marginal macroducts on each side ..... **micronesiensis**
   Gland tubercles restricted to lateral margins of first abdominal segment, elongate gland spines present on margins of segments 2 and 3; pygidium with 6 marginal macroducts on each side 3
3. Pygidium relatively elongate, distance from anal opening to apex about equal to maximum width; median lobes of pygidium apically acute, finely serrate along outer margins ..... **palauensis**
   Pygidium less elongate, distance from anal opening to apex less than maximum width; median lobes of pygidium apically rounded, notched laterally but not serrate along outer margins 4

4. Derm of head without small conical spines or minute spinules; prepygidial abdominal segments relatively broad, lateral lobes strongly protuberant; with 3 well-developed sclerotized spines, 1 each between segments 1 to 4, on lateral margin of abdomen on each side ..... **carolinensis**
   Derm of head bearing scattered small conical spines or numerous minute spinules; prepygidial abdominal segments relatively narrow, lateral lobes only slightly protuberant; with 2 or 3 weakly developed marginal sclerotized spurs between abdominal segments on each side 5
5. Dorsum of head with sparsely scattered small conical spines 2–3 μ in length .. **bladhiae** ?
   Dorsum and venter of head with relatively numerous minute conical spinules 1–1.5 μ long ..... **spinulosa**
6. With one or more of the free prepygidial abdominal segments bearing a sclerotized spine, spur, or boss on margin of each lateral lobe near intersegmental constriction, distinct from usual gland tubercles or gland spines 7
   Prepygidial abdominal segments without such sclerotized processes on lateral margins 9
7. Lateral lobes of abdominal segments 2 to 4 each with a sclerotized spine on anterior portion near intersegmental constriction; derm of dorsum of thorax and abdominal segment 1 sclerotized at maturity ..... **gloverii**
   Well-developed lateral sclerotized spines, if present, on not more than 2 of the prepygidial abdominal segments; derm of thorax and abdominal segment 1 unsclerotized at maturity 8
8. A small sclerotized boss on each side of abdominal segments 1, 2, and 4; numerous (15 to 20) small tubular ducts on dorsum of pygidium in a band on each side on abdominal segment 6 ..... **beckii**
   Without such small sclerotized bosses on prepygidial abdominal segments, with a small weakly sclerotized spur on each margin of lateral lobes of abdominal segments 2 and 3; very few (2 to 3) small tubular ducts on each side of dorsum of pygidium on abdominal segment 6 ..... **ulapa**
9. Head moderately to distinctly expanded on each side to form a lobular anterolateral projection ..... **tokionis**
   Head with anterior margin evenly rounded, not expanded laterally 10
10. Marginal ducts anterior to metathorax very few and extremely small, smaller than those along margins behind metathorax; a slender elongate species ..... **arii**
    Marginal ducts more numerous on anterior part of body, their size about the same as those along margins on posterior portion of body; a broad, robust species ... **esakii**

121. Lepidosaphes arii (Kuwana).

Mytilaspis (*Lepidosaphes*) *arii* Kuwana, 1909, New York Ent. Soc., Jour. **17** (4) : 163, pl. 12, figs. 27–31.

Lepidosaphes arii: Sasscer, 1911, U.S. Dept. Agric., Techn. Ser. **16** (4) : 71.

DISTRIBUTION: Bonin Is., no specific locality (type locality).

HOSTS: The type lot was from a grass, *Miscanthus* sp.

A recent slide preparation labeled only "Aug. 1943, Kuwana" is at hand. Presumably this slide was prepared from Kuwana's type lot of *L. arii*, collected in the Bonin Is. during 1907.

122. Lepidosaphes beckii (Newman).

Coccus Beckii Newman, 1869, Entomologist **4** : 217.

Mytilaspis beckii: Cockerell, 1899, Acad. Nat. Sci. Philadelphia, Proc. for 1899 : 275.

Lepidosaphes beckii: Fernald, 1902, Cat. Coccidae of World, 305.—Ferris, 1937, Atlas Scale Ins. North America S-I : 74.—Zimmerman, 1948, Insects of Hawaii **5** : 418, fig. 229.

DISTRIBUTION: Widespread (type locality: Europe).

S. MARIANA IS. GUAM: Dec. 1951, Borah, on orange.

TRUK. TONOAS (Dublon): Reported by Takahashi (1942 : 355) from citrus.

PONAPE. Colonia, Jan. 1949, Ross, on *Citrus paradisi* and *Citrus aurantium.*

MARSHALL IS. KWAJALEIN: July 1952, Davidson, on orange (in quarantine?).

HOSTS: *Citrus* spp.

123. Lepidosaphes bladhiae Takahashi (?).

Lepidosaphes bladhiae Takahashi, 1931, Soc. Trop. Agric., Taihoku Imp. Univ., Jour. **3** (4) : 379, fig. 2.—Takagi, 1960, Akitu **9** : 77, fig. 1.

Lepidosaphes cocculi: Takahashi, 1939, Tenthredo **2** (3) : 265.

Lepidosaphes mcgregori: Fullaway, 1946, B. P. Bishop Mus., Bull. **189** : 160.

Lepidosaphes tubulorum: Fullaway, 1946, B. P. Bishop Mus., Bull. **189** : 160 (misidentification).

DISTRIBUTION: Formosa (type locality), Philippine Is. ?, Micronesia ?

S. MARIANA IS. SAIPAN: Tanapag Harbor, June 1946, Fosberg and Townes, on *Bruguiera*; near Afetna Point, June 1946, Townes, on *Barringtonia asiatica*; near Tanapag Harbor, July 1946, Townes, on *Areca catechu*; Jan. 1948, Maehler, on *Artocarpus communis.* TINIAN: Mt. Lasso, June 1946, Oakley, on coconut. GUAM: July 1937, Oakley, on *Cestrum*; Libugon Farm, May 1938, Oakley, on asparagus; Dededo, Nov. 1938, Oakley, on coconut; Piti, June 1946, Oakley, on coconut; Merizo, July 1946, Fosberg, on *Bruguiera hexangula*; Tumon Bay, Dec. 1947, Maehler, on coconut; Talofofo, Dec. 1947, Maehler, on *Manihot esculenta*; Com. Mar. Hill (near Agana), Dec. 1948, Maehler, on coconut; April 1954, Parsons and Liming, on betel palm; Libugon, July 1936, Swezey, on mango fruit.

PALAU. KOROR: July 1953, Beardsley, on *Casuarina*, coconut, and soursop leaves. NGERKABESANG: Aug. 1953, Beardsley, on *Citrus* and guava leaves; Aug. 1953, Beardsley, on unidentified tree. PELELIU: July 1946, Oakley and Townes, on coconut. ANGAUR: Saipan, Kitumura, Feb. 1938, Esaki, on *Cycas circinalis.*

YAP. YAP: July 1946, Oakley, on *Areca catechu*; Yaptown, July 1946, Townes on *Rhizophora mucronata.*

PONAPE. Colonia, Sept. 1937, Esaki, on *Cycas*; Colonia-Jokaj, Nov. 1938, Esaki, on *Cycas*; Expt. Station near Colonia, Mar. 1948, Dybas, on *Alstonia scholaris* and *Hyophorbe verschaffeltii*; Nov. 1953, Beardsley, on coconut leaves.

WAKE. Nov. 1957, Krauss, on coconut leaf; Nov. 1959, Ford, on coconut leaf.

HOSTS: Reported from asparagus, breadfruit, betel palm, cassava, citrus, coconut, cycas, and various ornamental and uncultivated plants. Common on coconut, betel palm, and probably other palms as well.

It has been impossible to determine unequivocally the correct name for this common Micronesian *Lepidosaphes*. Takagi (1960) identified specimens from coconut from the Philippines as *L. bladhiae*, and I have examined Takagi's material and found it identical with Micronesian specimens. However, neither Takagi nor I have been able to examine authentic material of *L. bladhiae*, although Takahashi's types are believed to be in the Taiwan Agricultural Research Institute in Taipei. Either *L. mcgregori* Banks, or *L. cocculi* (Green) or both may be identical with the species treated here, but unfortunately, authentic material of neither of these species has been available. As it is likely that Banks' types of *mcgregori* were destroyed during the war, it may never be possible to identify his species with accuracy. I have tentatively assigned this species as *L. bladhiae*, following Takagi. It is hoped that authentic material of *L. bladhiae* and the two closely related forms mentioned above may eventually become available for study.

124. Lepidosaphes carolinensis Beardsley, n. sp. (fig. 33).

Lepidosaphes euryae: Takahashi, 1936, Tenthredo **1** (2) : 117 (misidentification).

Length of slide-mounted specimens 1.0–1.3 mm. Body form moderately elongate, fusiform, widest across abdominal segment 1. Head moderately rounded anteriorly, anterolateral margins not appreciably angulate. Abdominal segments 1 to 4 produced laterally, forming well-developed lobes.

Pygidium with median lobes moderately small, apical margin rounded, entire, mesal and sometimes outer margin with a slight notch; distance between median lobes equal to half the width of one. Second lobes well developed, relatively broad, mesal lobule more than one-half width, and a trifle shorter than a median lobe. A pair of gland spines present between median lobes, about as long as or slightly longer than lobes; 1 or 2 gland spines between median and second lobes; a pair between second lobes and site of obsolete third lobes; 1 or 2 just mesad of site of obsolete fourth lobes, and 1 or 2 slightly mesad of the opening of the anteriormost marginal macroduct. Pygidium with 6 marginal macroducts on each side. Dorsum of pygidium with 3 to 6 microducts, about 2–3 μ diameter, on each side of abdominal segment 7, and 10 to 17 such ducts on each side of segment 6. Abdominal segment 5 with about 40 to 60 dorsal microducts; 10 to 20 in a submarginal group on each side, and 20 to 40 in a transverse row along posterior margin of segment. A well-developed area of heavier sclerotization around anal opening, extending posteriorly as a barlike sclerosis about two-thirds distance from anal opening to apex of pygidium, and extending anteriorly to margin of abdominal segment 5 on each side so as to form an elongate Y-shaped sclerosis. Venter of pygidium with 60 to 70 perivulvar pores in five groups; anterior group

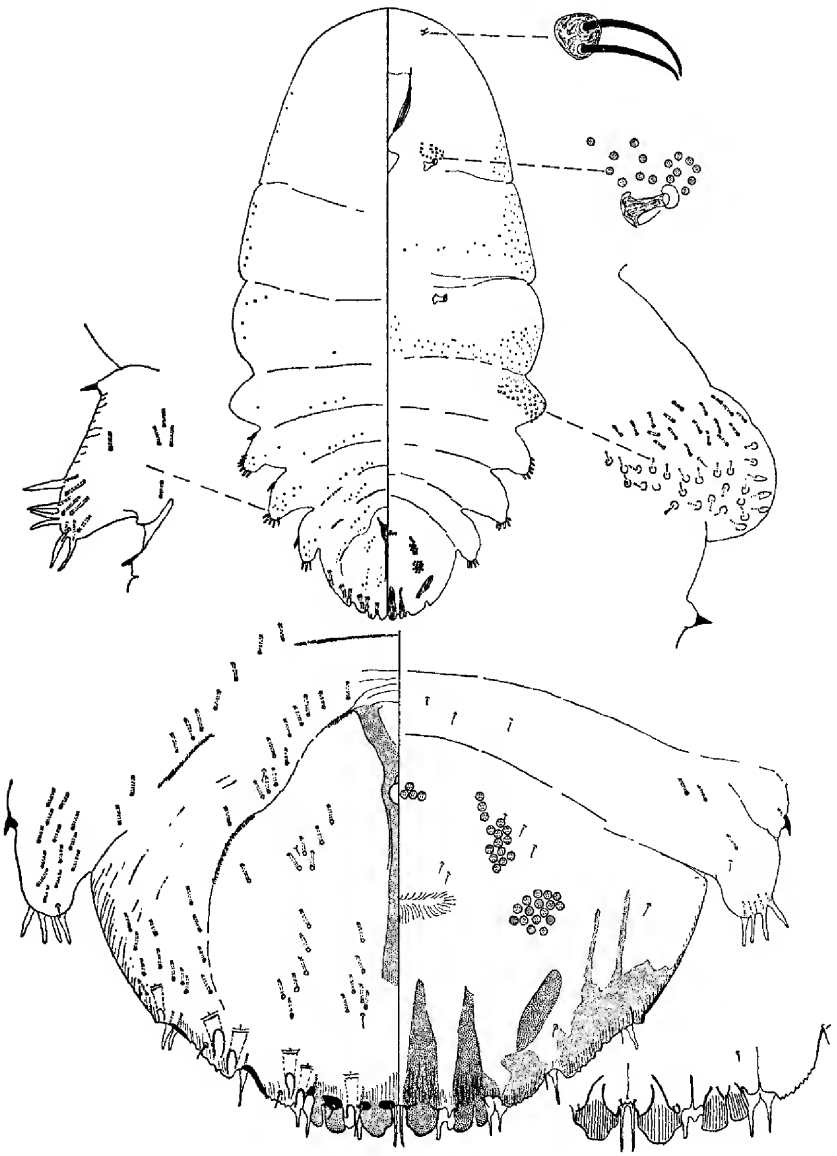

FIGURE 33.—*Lepidosaphes carolinensis*, adult female, dorsal and ventral aspects and details.

with 5 to 7 pores, lateral groups each with 15 to 20 pores. Venter of abdominal segment 1 with a band of 20 to 35 gland tubercles or short conical gland spines plus a band of 10 to 15 small tubular ducts, 2–3 μ diameter, anterior to gland tubercles, on each lateral lobe. Lateral lobes of abdominal segments 2 to 4 each with an apical group of 5 to 8 elongate gland spines. A single well-developed sclerotized spine near anterior edge of lateral lobe on lateral margins of abdominal segments 2 to 4. Dorsum of prepygidial abdominal segments each with numerous microducts scattered on lateral lobes, and in a submedian row on each side of segments 1 to 4. A few such ducts on lateral margins of dorsum of thoracic segments. Venter with a few microducts on each side of abdominal segments 2 to 4; thoracic segments each with a band of microducts along lateral margins of venter, extending transversely entirely across venter of mesothorax and metathorax; these pores much more numerous in transverse band of metathorax. Anterior spiracles each with 8 to 14 associated disc pores; posterior spiracles without associated pores. Antennal tubercles each bearing 2 large setae. Derm of head without discernible conical spines or spicules.

Holotype, female (BISHOP 6149) and paratype on one slide, Yap Is., Yap, July 2, 1956, McDaniel, on taro leaf blades and petioles. Six paratypes (US, UH) on 3 slides, same data as type.

Additional records: Palau Is., Koror, Feb. 1936, Esaki, on *Cycas*; Jan. 1954, Beardsley, on leaf of unknown tree.

DISTRIBUTION: Caroline Is. (Yap, Palau).

HOSTS: *Cycas*, taro, and unknown tree.

Lepidosaphes carolinensis appears to be allied to *L. euryae* Kuwana as the latter has been redefined and figured by Ferris (Microent. **1**: 7, fig. 4, 1936). Both are relatively robust species without conical spines or minute spicules on the head, but otherwise similar to *L. tubulorum* Ferris and others which possess characteristic minute dorsal tubular ducts and an elongate dorsal sclerosis extending posteriorly from anal opening. However, *L. euryae* differs from *L. carolinensis* in that it lacks sclerotized spines on lateral margins of abdominal segments 2 to 4, and has fewer dorsal microducts and fewer perispiracular disc pores.

125. Lepidosaphes esakii Takahashi.

Lepidosaphes esakii Takahashi, 1939, Tenthredo **2** (3) : 266, figs. 10 and 11.
Lepidosaphes duponti: Fullaway, 1946, B. P. Bishop Mus., Bull. **189** : 160 (misidentification).

DISTRIBUTION: Micronesia (type locality: Ponape).

N. MARIANA IS. PAGAN: Feb. 1959, Cantelo, on coconut. ALAMAGAN: Aug. 1948, Doutt, on coconut. ANATAHAN: Aug. 1951, R. M. Bohart, on coconut.

S. MARIANA IS. SAIPAN: Kalabera (Karabena), July 1939, Esaki, on *Cocos nucifera*; June 1946, Townes, on *Pandanus fragrans*; "native settlement," June 1946, Oakley, on coconut. ROTA: Sabana, June 1946, Townes, on *Pandanus tectorius*. GUAM: 1907, F. M. Potts, on coconut; Piti, June 1911, Fullaway, on coconut; Dec. 1911, Fullaway, on *Pandanus*; Inarajan, June 1936, Swezey, on coconut; Inarajan, Sept. 1938, Oakley, on coconut;

Mt. Alifan, Apr. 1946, Krauss, on *Pandanus*; in quarantine at Hawaii, San Diego, and San Francisco, various dates, various collectors, all on coconuts.

CAROLINE ATOLLS, WOLEAI: Utegal I., July 1946, Oakley, on coconut. FARAULEP: Yat I., Jan. 1964, Owen, on coconut. NUKUORO: "Masagumani," Aug. 1946, Oakley, on coconut.

TRUK. WENA (Moen): May 1946, Oakley, *Cocos nucifera*. PIS: June 1946, Oakley, on *Pandanus tectorius*.

PONAPE. Palikir-Colonia, Jan. 1938, Esaki, on *Pandanus*; Nipit-Ninoani, Jan. 1938, Esaki, on *Pandanus patina* (fruit); Colonia, Aug. 1946, Oakley, on coconut.

KUSAIE. Lele, Aug. 1946, Oakley, on coconut.

MARSHALL IS. UJELONG: Ujelong I., Oct. 1953, Beardsley, on base of coconut petioles. ENIWETOK: Japtan I., May 1946, Townes, on *Pandanus tectorius*; Apr. 1954, H. A. Messerschmidt, on coconut (in quarantine at Honolulu ?). KWAJALEIN: Aug. 1946, Oakley, on *Pandanus tectorius*; in quarantine at Hawaii, San Diego, various dates and various collectors, on coconut and *Pandanus*. LIB: Oct. 1953, Beardsley, on coconut petiole bases. JALUIT: Jibu I., May 1958, Gressitt, on *Pandanus* fruit. NAMORIK: Namorik I., Sept. 1953, Beardsley, on *Pandanus* fruit. LIKIEP: Likiep I., Aug. 1946, Townes, on *Pandanus tectorius*. MAJURO: Majuro I., Aug. 1946, Oakley, on *Pandanus tectorius* and coconut; Telap (Delap) I., Aug. 1946, Oakley, on coconut.

HOSTS: *Pandanus* spp. and coconut. Takahashi (1939, 1941) recorded this scale from Saipan, Truk, and Ponape, on coconut and *Pandanus*.

This species is close to *L. duponti* Green (1916 : 195). A cotype of the latter species in the U.S. National Coccid Collection was examined, and the following differences noted. The median lobes of *L. duponti* examined are wider and closer together than in *esakii* specimens. The inner lobule of the second lobes of *duponti* is also much wider than that of *esakii*. Both the living insect and the female scale appear to be much narrower in *duponti* than in *esakii*, although many Micronesian specimens assigned to the latter species do not show the extreme breadth of the scale illustrated by Takahashi (1939).

126. Lepidosaphes gloverii (Packard).

Coccus gloverii Packard, 1869, Guide to Study of Insects, First ed., 527.
Aspidiotus gloverii Packard, 1870, Seventh Rept., Mass. Bd. Agric., 259.
Lepidosaphes gloverii: Kirkaldy, 1902, Fauna Hawaiiensis **3** (2) : 111.—Ferris, 1937, Atlas Scale Ins. North America S-I : 74.—Zimmerman, 1948, Insects of Hawaii **5** : 420, fig. 231.

DISTRIBUTION: Widespread (type locality: Florida).

BONIN IS.: Kuwana collector, no further data. Kuwana (1909 : 161) reported "*Mytilaspis pallida* Green" from *Citrus* sp. from the Bonin Islands. It seems likely that this record represents a misidentification of *L. gloverii*.

S. MARIANA IS. SAIPAN: Chalan Laulau, June 1946, Oakley, on citrus.

TRUK. WENA (Moen): May 1946, Oakley, on lime; Jan. 1949, Ross, on citrus.

PONAPE. Expt. Station near Colonia, Aug. 1946, Oakley, on orange leaves.

HOSTS: Various species of *Citrus*. Has been recorded from croton, palms, etc., in other parts of the world. Takahashi (1936–1942) recorded *L. gloverii* from Saipan, Truk, and Ponape, all on citrus.

127. Lepidosaphes micronesiensis Takahashi.

Lepidosaphes micronesiensis Takahashi, 1942, Tenthredo **3** (4) : 355, fig. 2.

Lepidosaphes sp., Takahashi, 1939, Tenthredo **2** (3) : 268; 1941, ibid. **3** (3) : 219.

DISTRIBUTION: Caroline Is. (type locality: Ponape).

PONAPE. Lehdau-Wene (Raitao-One), July 1939, Esaki, on *Coelococcus amicarum* (ivory nut palm).

HOST: This species is known only from the type collection on ivory nut palm.

128. Lepidosaphes palauensis Beardsley, n. sp. (fig. 34).

Female. Length of slide-mounted specimens 0.8–1.2 mm. Body elongate, fusiform, widest across abdominal segment 1; anterior margin of head truncate or nearly so, its anterolateral margin moderately angulate. Abdominal segments 1 to 4 with moderately well-developed lateral lobes.

Pygidium relatively elongate, anal opening situated farther from posterior apex than from lateral margins of abdominal segment 4. Median lobes well developed, apical portion triangular in outline, outer margins finely serrate, but not notched laterally; set fairly close together, distance between less than one-half width of one. Second pygidial lobes well developed, mesal lobule slightly less than one-half as wide, and about two-thirds as long as median lobe, its outer margin finely serrate. A pair of gland spines between median lobes; a pair on each side between median and second lobes; a pair between second lobes and site of obsolete third lobes; 1 just mesad of site of obsolete fourth lobes; and 1 or 2 on margin near opening of anteriormost dorsal macroduct on each side. Dorsum of pygidium with 6 well-developed marginal macroducts on each side; 1 opening between median and second lobes, 2 between second and obsolete third lobes, 2 between obsolete third and fourth lobes, and 1 anterior to site of obsolete fourth lobes. Dorsum of pygidium with a few submedian microducts approximately 2 μ in diameter; 2 to 3 on each side of segment 7, 5 to 8 on each side of segment 6. Anal opening surrounded by a well-defined area of heavier sclerotization which extends posteriorly as a median sclerotized bar for somewhat less than one-half the distance to apex of pygidium. Venter of pygidium with 5 groups of perivulvar pores totaling 20 to 25 pores in available specimens. Prepygidial abdominal segments with numerous microducts dorsally and laterally; segments 2 to 5 each with a submedian group of 6 to 8 ducts on each side, and many (10 to 20) ducts opening on dorsum of lateral lobes on each side. Venter on abdominal segment 1 with a group of about 15 small gland tubercles on each side, the outermost becoming elongated into small gland spines. Lateral lobes

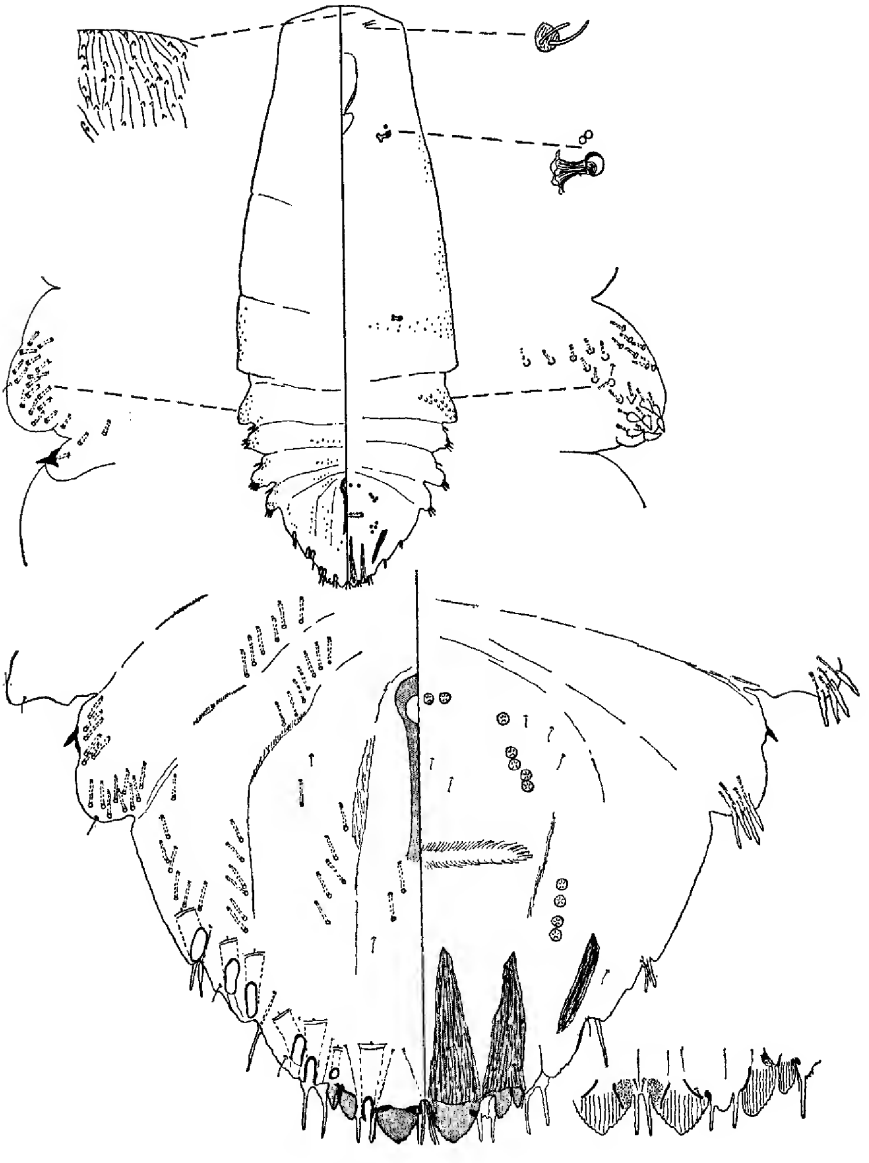

FIGURE 34.—*Lepidosaphes palauensis*, adult female, dorsal and ventral aspects and details.

of abdominal segments 2 to 4 each with a group of 3 to 5 elongate gland spines at apex. Abdominal segments 2 to 4 each with a sclerotized spine on anterior edge of margin of lateral lobe on each side. Thoracic segments each with a band of micropores along lateral margins of venter; band on metathorax extending mesad to area just behind posterior spiracles. One or two disc pores associated with each anterior spiracle, absent near posterior spiracles. Antennal tubercles each with 2 well developed setae. Derm of anterior part of head sparsely clothed with very minute spicules, without conspicuous small conical spine-like projections.

Holotype, female (BISHOP 6150), and 1 paratype on one slide, Palau Is., Ngurukdabel (Urukthapel), Aug. 1953, Beardsley, on leaf of unidentified tree. Seven paratypes (US, UH) on 3 slides, same data as type. A fifth slide, Airai, Babelthuap, Palau Is., Aug. 1953, Beardsley, on soursop leaves, with 2 specimens, 1 a preadult female, 1 an adult female infested with fungus, is definitely assignable to *L. palauensis* on basis of characters of the pygidium of the adult specimen.

DISTRIBUTION: Caroline Is. (Palau).

HOSTS: Soursop, unidentified tree (on leaves).

This species obviously belongs to the group which included *L. tubulorum* Ferris, *L. bladhiae* Takahashi, and several other described forms characterized by very minute tubular ducts on the dorsum of pygidium and anterior abdominal segments. The elongate pygidium, triangular median lobes, and well-developed lateral spines on abdominal segments 2 to 4 will distinguish *L. palauensis* from any other species known to me.

129. Lepidosaphes spinulosa Beardsley, n. sp. (fig. 35).

Length of slide-mounted specimens 0.7–0.9 mm. Body form elongate, fusiform, widest across metathorax or abdominal segment 1. Head rounded anteriorly, anterolateral margins not angulate. Abdominal segments 1 to 4 only slightly produced laterally, not forming strongly protuberant lateral lobes.

Pygidium with median lobes moderately broad and well developed, about 16 μ wide, apical margins with 2 or 3 weak notches on each side; distance between median lobes equal to approximately one-half width of one; slightly more in some specimens. Second lobes well developed, combined width of the two lobules approximately equal to that of one median lobe; length of mesal lobule about equal to that of median lobe. With a pair of gland spines between median lobes, slightly longer than lobes; a similar gland spine between median and second lobes on each side; a pair of gland spines between second lobes and site of obsolete third lobes, mesal spine longest, slightly longer than those between median lobes; a pair between sites of obsolete third and obsolete fourth pygidial lobes, conspicuously longer than those between median lobes, about 20 μ in length; a similar pair cephalad of site of fourth lobes and slightly mesad of site of anteriormost marginal macroduct on each side. Dorsum of pygidium with 6 marginal macroducts on each side; with 2 or 3 microducts, about 3 μ diameter, on each side on abdominal segment 7; 4 or 5 microducts on each side of abdominal segment 6; a submedian series of 4 or 5 such ducts on each side of segments 3 to 5; about 6 to 10 slightly smaller microducts sublaterally on each side of segments 3 to 5. A well-developed area of heavier sclerotization present around anal opening, extending posteriorly as a narrow median barlike sclerosis, about four-fifths distance to apex of pygidium. Venter of pygidium with about 20 to 30 perivulvar pores arranged in 5 groups; anterior group with 3 to 5 pores, lateral groups each with 4 to 6 pores. Venter of abdominal segment 1 with a band of 20 to 30 gland tubercles on each side, plus a band of around 15 to 20 small tubular ducts, 2–3 μ diameter, anterior to gland tubercles on each side.

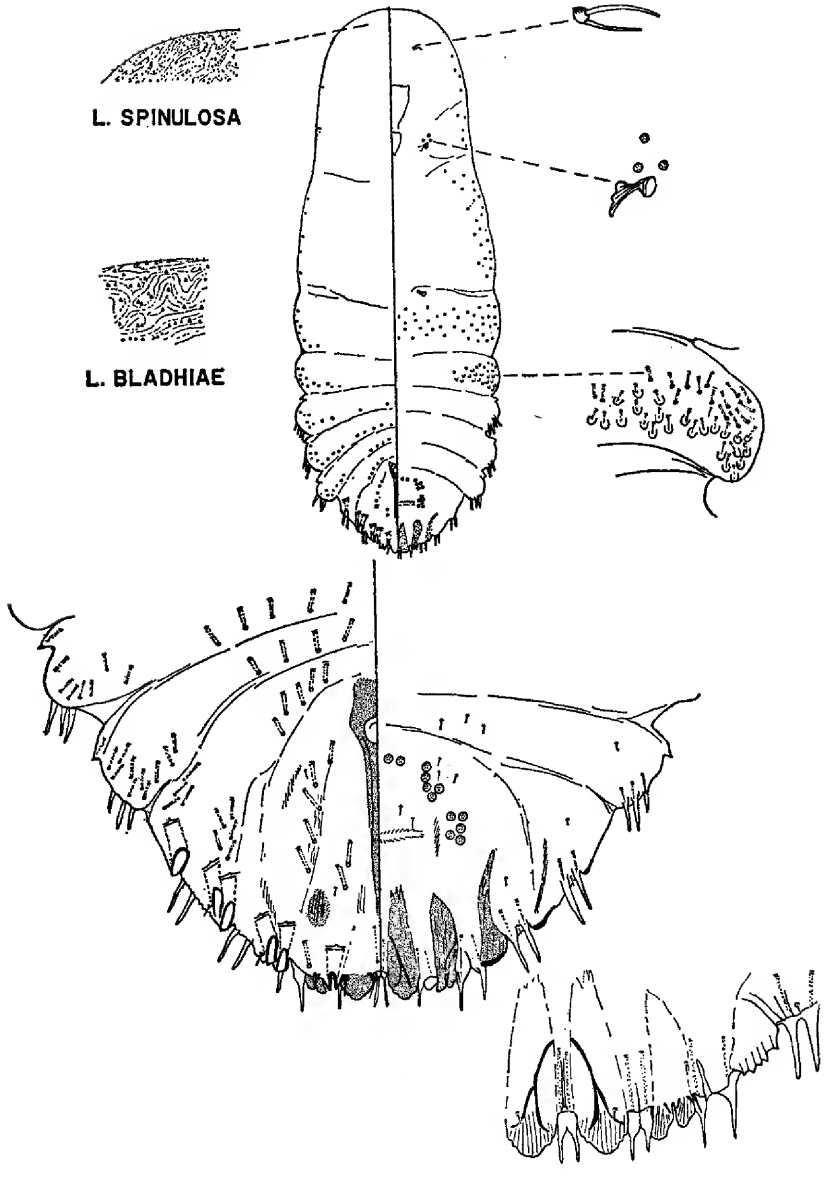

FIGURE 35.—*Lepidosaphes spinulosa*, dorsal and ventral aspects and details. Detail of derm of head of *L. bladhiae* Takahashi inserted for comparison.

Lateral lobes of abdominal segments 2 to 4 each with 3 or 4 elongate gland spines about 18–22 μ long. A lobular projection, usually with a pointed sclerotized tip, present on anterior portion of lateral margin of lateral lobes of abdominal segments 2 to 4 on each side. Dorsum of prepygidial abdominal segments each with a few small micropores on lateral lobes, segments 2 to 4 each with a submedian series of 2 to 5 such ducts on each side; a few microducts discernible along lateral margin of dorsum of thorax. A sparse transverse band of micropores extending across venter of metathorax; a few micropores scattered along lateral margins of pro- and mesothorax. Anterior spiracles each with 2 or 3 associated disc pores; posterior spiracles without associated disc pores. Antennal tubercles small, each bearing 2 or 3 setae about 13 μ maximum length. Derm of anterior portion of head bearing numerous, very minute, conical spinules, 1–1.5 μ long, on both dorsum and venter.

Holotype, female (BISHOP 6151) and one paratype on one slide, Palau Is., Koror, April 1954, Beardsley, on bark of *Glochidion* sp.; 16 paratypes (US, UH, BISHOP) on 7 slides, same data as holotype.

Additional specimens: Piti, Guam, S. Mariana Is., July 1936, Swezey, on rose; Talofofo, Dec. 1948, Maehler, on eggplant.

DISTRIBUTION: S. Mariana Is. (Guam); Caroline Is. (Palau).

HOSTS: Eggplant, *Glochidion* sp., rose. Apparently a bark-infesting species.

Lepidosaphes spinulosa is very similar to the species which has been considered tentatively as *L. bladhiae* Takahashi. The most salient difference between these two forms is in the minute ornamentation of the anterior part of the head. In *L. spinulosa*, both dorsal and ventral surfaces of the head are relatively thickly set with very minute conical spinules, each about 1 to 1.5 μ long. In *L. bladhiae* the dorsum of the head is relatively sparsely clothed with noticeably larger conical spinules, each 2 to 3 μ in length; the spinules of the ventral surface are much smaller.

130. Lepidosaphes tokionis (Kuwana).

Mytilaspis newsteadi var. *tokionis* Kuwana, 1902, Calif. Acad. Sci., Proc. III, **3**: 81.

Lepidosaphes newsteadi tokionis: Fernald, 1903, Cat. Coccidae of World, 312.

Mytilaspis auriculata Green, 1907, Linn. Soc. London, Trans. **12** (2): 205, fig.

Lepidosaphes lasianthi: Kotinsky, 1910, Hawaiian Ent. Soc., Proc. **2** (3): 130 (misidentification).—Ferris, 1938, Atlas Scale Ins. North America S-II: 145 (misidentification).—Takahashi, 1936–1941, Tenthredo **1** (2): 117; **2** (3): 265; and **3** (3): 218 (misidentifications).

Lepidosaphes tokionis: Ferris, 1942, Atlas Scale Ins. North America S-IV: 398.—Zimmerman, 1948, Insects of Hawaii **5**: 426, fig. 234.

DISTRIBUTION: Widespread (type locality: Tokyo, Japan).

S. MARIANA IS. GUAM: Duenas School, Jan. 1954, Liming, on *Capsicum* leaf.

PALAU. KOROR: Jan. 1954, Beardsley, on leaves and bark of croton.

YAP. YAP: Kolonia, Mar. 1954, Beardsley, on leaves of croton.

HOSTS: Most records are from crotons (*Codiaeum* spp.). Takahashi (1936–1941) recorded this species (as *L. lasianthi*) from Saipan, Yap, Palau, and Truk, all on croton.

131. Lepidosaphes ulapa Beardsley, n. sp. (fig. 36).

Length of slide-mounted specimens 0.7–1.0 mm. Body elongate, slightly fusiform, widest across abdominal segment 1. Anterior margin of head truncate or nearly so. Lateral lobes of abdominal segments 1 to 4 slightly to moderately produced.

Pygidium with median lobes well developed, distance between them approximately equal to width of one; outer margin subtriangular in outline, faintly to moderately definitely notched; ventral basal paraphyses moderately well defined. Second lobes well developed, mesal lobule one-half to two-thirds as wide as median lobe; outer lobule narrower. Marginal gland spines of pygidium moderately short, hardly or not at all exceeding median lobes in length; 1 pair between median lobes, 1 pair on each side between median and second lobes; 1 pair between second lobes and site of obsolete third lobes, 1 pair between sites of obsolete third and fourth lobes, 1 pair near opening of anterior-most marginal macroduct. Pygidium with 6 dorsal marginal macroducts on each side. Dorsum of abdominal segment 6 with 2 small ducts about 6 μ wide on each side; abdominal segment 5 with 2 such ducts submarginally and usually 2 submedially on each side. Venter of pygidium with around 20 to 25 perivulvar pores arranged in 5 groups. Dorsum of abdominal segments 3 and 4 each with a submedian row of 3 or 4 and a marginal group of around 4 to 8 small ducts on each side. Dorsum of metathorax and first 2 abdominal segments with marginal groups of 4 to 8 ducts on each side; submedian ducts wanting on these segments. Abdominal segments 2 and 3 each with a weakly sclerotized spur, with a small apical point and a duct orifice on its posterior margin, situated on anterior part of margin of each lateral lobe. Abdominal segment 4 with a narrow weakly sclerotized area surrounding a duct orifice in a similar position on margin, but not forming a point-tipped spur. Apices of lateral lobes of abdominal segments 2 to 4 each bearing 2 or 3 moderately elongate gland spines. Venter of each side of abdominal segment 1 with a few (around 8 to 12) small gland tubercles. Venter of each side of metathorax with a few (6 to 8) such gland tubercles, plus a few (10 to 15) small marginal tubular ducts.

Anterior spiracles each with 1 or 2 associated disc pores. Antennal tubercles each with 2 large setae. Derm of anterior portion of head bearing a scattering of exceedingly small, barely discernible spicules.

Holotype, female (BISHOP 6152) and 1 paratype on one slide, Palau Is., Koror, Jan. 1954, Beardsley, on leaves of *Eugenia javanica*. Two paratypes (US) on one slide, same data as type.

DISTRIBUTION: Caroline Is. (Palau).

HOST: *Eugenia javanica*.

Lepidosaphes ulapa resembles *L. tokionis* (Kuwana) in the shape of the body and development of the pygidium. The latter species differs in lacking the small sclerotized spurs on margins of abdominal segments 2 and 3, in having more numerous small tubular ducts on dorsum of the pygidium, and in possessing a submedian series of tubular ducts on each side of abdominal segments 1 to 6, instead of on segments 3 to 6 only as in *ulapa*.

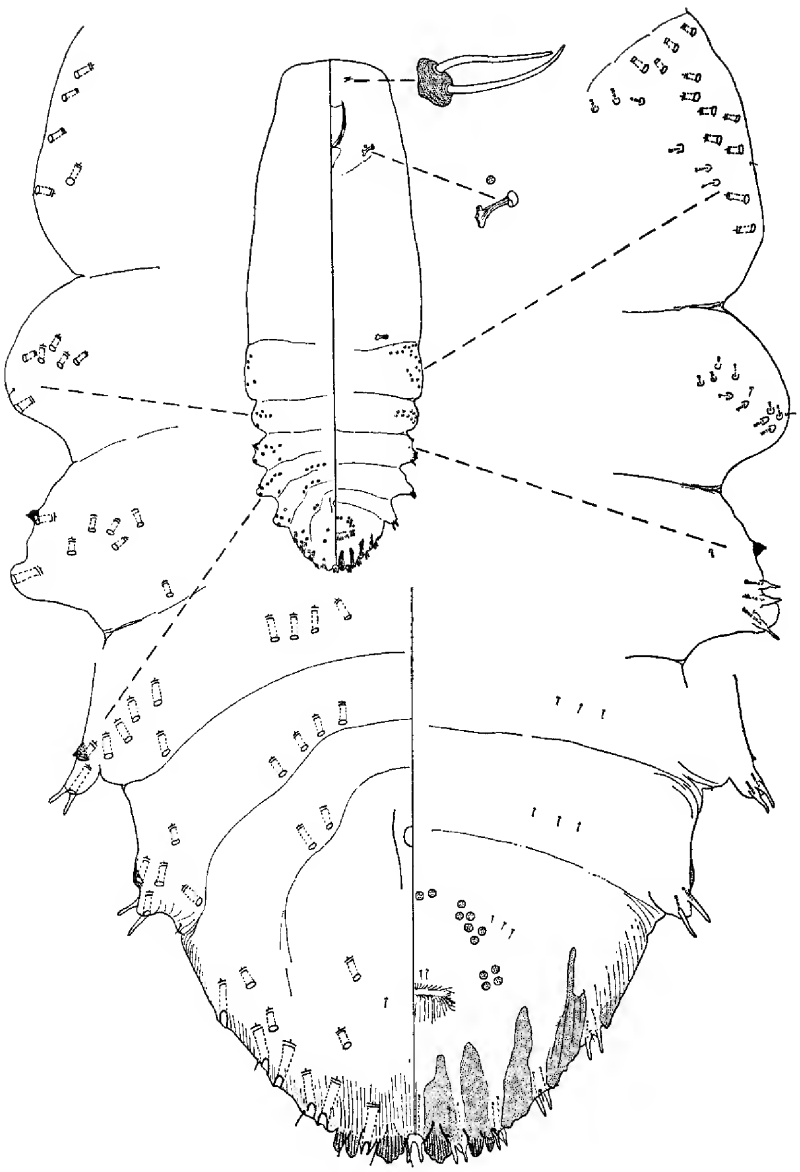

FIGURE 36.—*Lepidosaphes ulapa*, adult female, dorsal and ventral aspects and details.

Genus **Palauaspis,** new genus

Recognition characters: Diaspidinae with numerous small double barred ducts; at least a few marginal gland spines on posterior part of pygidium; without fringe plates. Antennal tubercles bearing 2 or more setae; anterior spiracles each with an adjacent group of several disc pores.

Body form elongate, fusiform. Thorax and prepygidial abdominal segments without elongate gland spines; gland tubercles wanting or at most represented by a few poorly defined tubercles on lateral margins of abdominal segment 3 in the type species. Pygidium with median lobes small, well separated, and not yoked basally by an internal sclerosis; second pair of lobes reduced to small bilobate sclerotized protuberances. Dorsum of pygidium with numerous small macroducts with sclerotized oral rims; similar ducts present on both dorsum and venter of prepygidial abdominal segments, thorax, and head, particularly in lateral areas. Venter of pygidium and prepygidial abdominal segments with numerous very small tubular ducts.

Type of genus: *Palauaspis multiductus*, n. sp.

Palauaspis is allied to the *Lepidosaphes* group of genera (Subtribe Lepidosaphedina of Balachowsky, 1954); particularly *Coccomytilus* Leonardi. The type species of the latter, *C. convexa* (Maskell), as illustrated by Ferris [1941, Microent. **6** (1) : 12, fig. 6], differs from the type species of *Palauaspis* in having the dorsal derm sclerotized, in lacking numerous tubular ducts on dorsum of head and thorax, and in possessing well-defined gland tubercles on venter of thorax and prepygidial abdominal segments.

Many genera allied to *Lepidosaphes* are currently recognized; all seem as distinct from *Palauaspis* as they do from one another (see Hall, 1946).

132. **Palauaspis multiductus** Beardsley, n. sp. (fig. 37).

Length of slide-mounted specimens 0.9–1.3 mm. Body fusiform, broadest across abdominal segment 1. Pygidium with a pair of small, roughly triangular, median lobes, separated at their bases by a distance equal to about one-half the width of one; without discernible basal paraphyses. Second pygidial lobes much reduced, represented by a pair of sclerotized points on each side; third and fourth lobes vestigial, represented by slight sclerotized protuberances on pygidial margin. A pair of elongate gland spines located between median lobes, about as long as or slightly longer than lobes; a pair of gland spines on margin of pygidium between median and second lobes, a pair between second lobes and vestigial third lobes, and usually 1 or 2 such gland spines just mesad of the site of vestigial fourth lobes, on each side. Prepygidial abdominal segments without discernible gland spines or gland tubercles. Dorsum of pygidium with a single marginal macroduct on each side between median and second lobes, its inner apex about 7 μ wide; with numerous noticeably smaller macroducts distributed in about 5 irregular series on each side of pygidium, totaling around 120 to 150 for entire pygidium (abdominal segments 5 to 7); these ducts each about 4 μ wide at inner apex, and with a slitlike orifice 3–4 μ long, surrounded by a ring of noticeably heavier sclerotization. Similar small macroducts distributed on dorsum of head, thorax, and prepygidial abdominal segments as indicated in figure. Venter of pygidium with numerous minute tubular ducts about 2 μ diameter at orifice and 2 μ wide at inner apex, extending anteriorly from margin in three principal series on each side; mesal series arising just lateral of bases of second lobes, second series originating just mesad of bases of obsolete fourth lobes, and third series arising on margin of abdominal segment 5. Perivulvar pores absent. Derm of midventral area of pygidium anterior to vulva and on posterior abdominal segments clothed with tiny papillae bearing minute apical spines. Venter of abdominal segments 2 to 4 without small macroducts; but bearing numerous microducts, of the type found on venter of pygidium, scattered across venter of each seg-

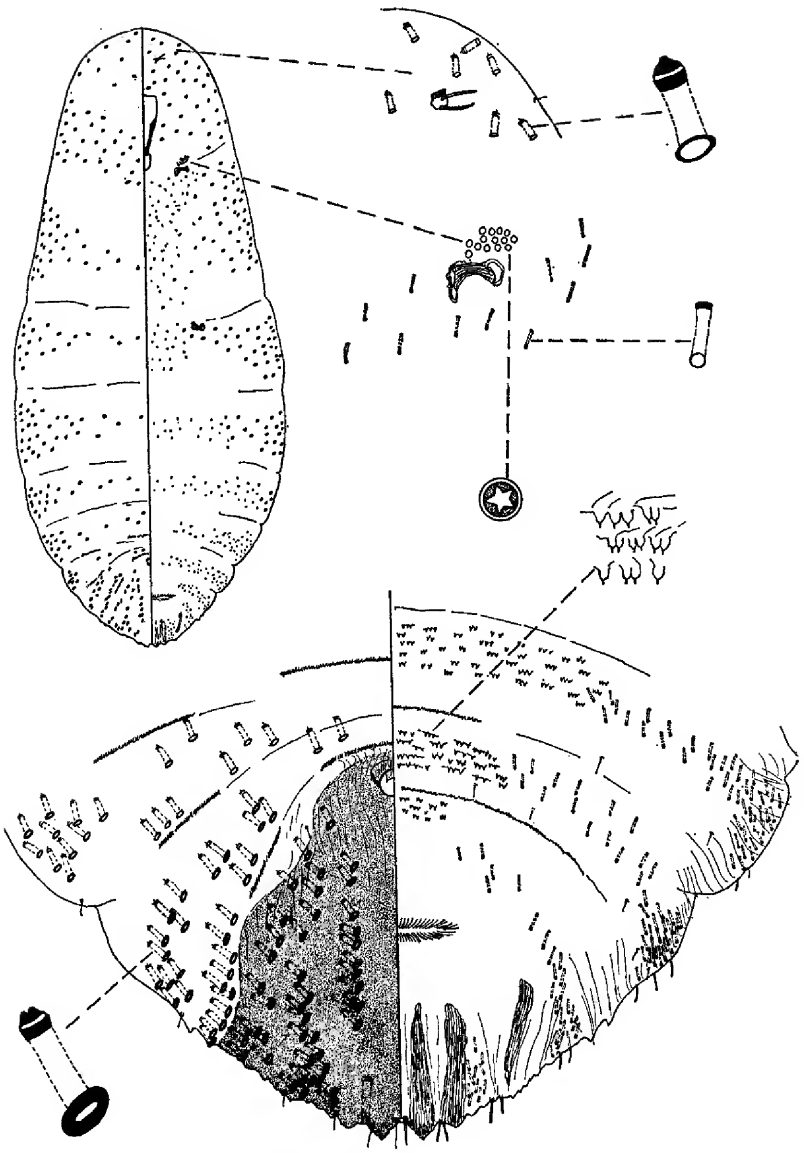

FIGURE 37.—*Palauaspis multiductus*, adult female, dorsal and ventral aspects and details.

ment. First abdominal and thoracic segments each with small macroducts on lateral margins of venter in addition to microducts. Venter of head with scattered small macroducts. Antennal tubercles each with 2 long setae. Anterior spiracles each with 8 to 15 associated disc pores; posterior spiracles without associated disc pores.

Female scale brownish, elongate, of typical Lepidosaphine form, widest at posterior end. Scales on scaly bark of host twigs at bases of leaf petioles and on petiole scars, and sometimes on surface of leaves, particularly along the midrib.

Described from 23 specimens. Holotype, female (BISHOP 6153) and 6 paratypes on one slide, Palau Is., Ngerkabesang, Feb. 1954, Beardsley, on twigs of *Barringtonia* sp. Sixteen paratypes (US, UH) on 3 slides, same data as type.

DISTRIBUTION: Caroline Is. (Palau).

HOST: *Barringtonia* sp.

Genus **Parlatoria** Targioni-Tozzetti

Parlatoria Targioni-Tozzetti, 1868, Soc. Ital. Sci. Nat. Atti., **11**: 735.—Ferris, 1937, Atlas Scale Ins. North America S-I: 84.—McKenzie, 1945, Microent. **10** (2): 50.

Type of genus: *Aspidiotus proteus* Curtis.

In McKenzie's revision of the genus *Parlatoria* and several related genera (1945), he includes a detailed consideration of nomenclatural problems involving the genus, a key to species, and redescriptions and figures of the known forms.

Key to Species of Parlatoria Known From Micronesia (in part after Zimmerman, 1948)

1. With a large conspicuous lateral membranous lobe on each side of head, about opposite anterior spiracle; female scale composed principally of a large black second exuvium ..... **zizyphus**
   Without such a membranous lobe on each side of head; female scale not largely black .. 2
2. Dorsum of pygidium with two longitudinal rows of macroducts on each side of pygidium on abdominal segments 6 and 7, extending cephalad to well anterior of anal opening ..... **cinerea**
   Dorsum of pygidium without such rows of macroducts, macroducts not found anterior to anal opening on these segments 3
3. Head bearing small, acute, distinctly sclerotized spine on each side (ocular spur); lateral submarginal macroducts less numerous, around 45 or less on each side 4
   Head without such a sclerotized ocular spur on each side; dorsal submarginal macroducts more numerous, 50 to 70 on each side ..... **pergandii**
4. Fourth pygidial lobes absent or represented by an unsclerotized projection which, except for smaller size, resembles adjacent fringe plates; with about 25 or fewer dorsal submarginal macroducts on each side ..... **proteus**
   Fourth pygidial lobes represented by small, distinctly sclerotized, somewhat dentate point; with about 25 to 45 dorsal submarginal macroducts on each side ..... **crotonis**

133. Parlatoria cinerea Hadden.

Parlatoria cinerea Hadden, 1909, Canadian Ent. **41**: 299, fig. 9.—McKenzie, 1945, Microent. **10** (2): 59, fig. 33.

Parlatoria pseudopyri Kuwana and Muramatsu, 1932, Nippon Plant Protect. Soc., Jour. Plant Protect. **19**: 8, fig. (in Japanese).

DISTRIBUTION: Widespread (type locality: Society Is., Tahiti).

S. MARIANA IS. SAIPAN: Reported by Takahashi (1939), on citrus. GUAM: Libugan Farm, July 1939, Oakley, on grapefruit.

HOSTS: Has been recorded elsewhere from citrus of several kinds, mango, and several other hosts.

134. Parlatoria crotonis Douglas.

Parlatoria proteus var. *crotonis* Douglas, 1887, Ent. Mo. Mag. **23**: 242.—Cockerell, 1882, Ins. Life **4**: 334.

Parlatoria greeni Banks, 1906, Philippine Jour. Sci. **1**: 222, 231, figs.

Parlatoria crotonis: Morrison, 1939, U.S. Dept. Agric., Misc. Pub. **334**: 12, fig.—McKenzie, 1945, Microent. **10** (2): 61, fig. 36.—Zimmerman, 1948, Insects of Hawaii **5**: 396, fig. 207.

DISTRIBUTION: Widespread (type locality: London, England, under glass).

PALAU. KOROR: Jan. 1954, Beardsley, on croton leaf.

TRUK. WENA (Moen): Oct. 1952, Beardsley, on croton leaves.

HOST: Croton (*Codiaeum* spp.).

135. Parlatoria pergandii Comstock.

Parlatoria pergandii Comstock, 1881, U.S. Dept. Agric., Rept. for 1880: 327, fig.—McKenzie, 1945, Microent. **10** (2): 70, fig. 48.—Zimmerman, 1948, Insects of Hawaii **5**: 396, fig. 210.

Parlatoria sinensis Maskell, 1897, Ent. Mo. Mag. **32**: 241.

DISTRIBUTION: Widespread (type locality: Florida).

BONIN IS. No date or locality, Kuwana.

TRUK. WENA (Moen): Takahashi (1941) recorded this species on citrus.

PONAPE. Expt. Station, near Colonia, Aug. 1946, Oakley, on orange leaves.

HOSTS: Has been recorded from *Citrus* and various other hosts elsewhere.

136. Parlatoria proteus (Curtis).

Aspidiotus proteus Curtis, 1843, Gardener's Chronicle, 676 (not seen).

Diaspis parlatoris Targioni-Tozzetti, 1867, Soc. Ital. Sci. Nat., Mem. **3** (3): 4.

Parlatoria orbicularis Targioni-Tozzetti, 1868, Soc. Ital. Sci. Nat., Atti. **11**: 735.

Parlatoria proteus: Fernald, 1903, Cat. Coccidae of World, 320.—McKenzie, 1945, Microent. **10** (2): 72, fig. 50.—Zimmerman, 1948, Insects of Hawaii **5**: 396, fig. 213.

DISTRIBUTION: Widespread (type locality: London, England, under glass).

BONIN IS. Kuwana (1909) records this species from the Bonin Is. on *Citrus* sp.

S. MARIANA IS. GUAM: Piti, July 1936, Swezey, on *Jasminum sambac*; Aug. 1938, Oakley, on *Gardenia*; Inarajan, Mar. 1948, Maehler, on *Nipa fruticans*; Dec. 1953, Liming, on *Triphasia trifolia*; Jan. 1954, Liming, on *Gardenia jasminoides*.

PALAU. BABELTHUAP: Ulimang, Dec. 1947, Dybas, on *Areca* palm. KOROR: July 1953, Beardsley, on leaves of wild ginger; Jan. 1954, Beardsley, on coconut leaves and leaves of *Eugenia javanica*. NGERKABESANG: Aug. 1953, Beardsley, on citrus leaves.

YAP. YAP: July 1946, Oakley, on citrus; Apr. 1950, Langford, on citrus leaves.

CAROLINE ATOLLS. NUKUORO: Nukuoro I., Aug. 1946, Oakley, on *Citrus*.

TRUK. TON (Tol): May 1946, Townes, on *Psychotria* sp.

PONAPE. Kiti, Aug. 1946, Oakley, on mango; Expt. Station near Colonia, Jan. 1949, Ross, on *Citrus paradisi* and *C. aurantium*.

KUSAIE. Lele, Aug. 1946, Oakley, on orange; Lele I., Mar. 1953, Clarke, on *Nipa fruticans*; Tafunsak, Mar. 1953, Clarke, on citrus.

HOSTS: Betel palm, *Citrus* spp., coconut, mango, *Nipa fruticans*, and many other plants. Takahashi (1936–1941) recorded *P. proteus* from Yap, Palau, and Ponape, on *Citrus*, *Cycas*, and *Gardenia radicans*.

137. Parlatoria zizyphus (Lucas).

Coccus zizyphus Lucas, 1853, Soc. Ent. France, Bull. III, **1**: XXVIII.

Parlatoria zizyphus: Signoret, 1869, Soc. Ent. France, Ann. IV, **9**: 451.—McKenzie, 1945, Microent. **10** (2): 76, fig. 53.—Zimmerman, 1948, Insects of Hawaii **5**: 404, fig. 216.

DISTRIBUTION: Widespread (type locality: Europe).

PALAU. BABELTHUAP: July 1946, Townes, on citrus; Ngiwal, Apr. 1953, Beardsley, on citrus. KOROR: Nov. 1947, Dybas, on citrus; Jan. 1953, Beardsley, on citrus leaves.

PONAPE. Colonia, Jan. 1949, Ross, on *Citrus aurantium*.

HOSTS: Various species of *Citrus*.

Genus **Phenacaspis** Cockerell and Cooley

Phenacaspis Cockerell and Cooley, 1899, Illinois State Lab. Nat. Hist., Bull. **5**: 398 (footnote).—Ferris, 1958, Microent. **20** (3): 43.

Type of genus: *Chionaspis nyssae* Comstock.

Ferris (1955, 1956) has reviewed the genus *Phenacaspis* and illustrated most of the known species. The group is still inadequately understood, however. Two forms have been found in Micronesia, but these eventually may prove to belong to a single variable species.

Key to Micronesian Species of Phenacaspis

With 20 to 35 submarginal abdominal macroducts on each side; anterior spiracles each with 5 or fewer associated disc pores; gland tubercles limited to 1 or 2 on each side of metathorax ..... **inday**

With 40 to 65 submarginal abdominal macroducts on each side; anterior spiracles each with 8 to 14 associated disc pores; 3 or 4 gland tubercles on each side of metathorax ..... **cockerelli**

138. Phenacaspis cockerelli (Cooley).

Chionaspis cockerelli Cooley, 1897, Canadian Ent. **29**: 278.

Phenacaspis cockerelli: Fernald, 1903, Cat. Coccidae of World, 237.—Ferris, 1955, Microent. **20** (3): 46, fig. 35.

Phenacaspis eugeniae var. *sandwicensis* Fullaway, 1932, Hawaiian Ent. Soc., Proc. **8** (1): 103.

Phenacaspis sandwicensis: Zimmerman, 1948, Insects of Hawaii **5**: 386, fig. 199.

DISTRIBUTION: Widespread (type locality: in quarantine at San Francisco, from China).

BONIN IS. Chichi Jima: July 1958, Owen, on *Nerium oleander*; Sept. 1959, Mitchell, on oleander leaves.

HOSTS: Occurs on a variety of hosts in Hawaii; common on mango, oleander, various palms, and other plants.

139. Phenacaspis inday (Banks).

Chionaspis candida Banks, 1906, Philippine Jour. Sci. **1**: 232, pl. 4 (preoccupied).

Chionaspis inday Banks, 1906, Philippine Jour. Sci. **1**: 787.

Phenacaspis inday: Robinson, 1917, Philippine Jour. Sci. **12** (D): 20.—Ferris, 1955, Microent. **20** (3): 50, fig. 41.

DISTRIBUTION: Philippine Is. (type locality: Manila), Micronesia.

S. MARIANA IS. GUAM: Fullaway (1946: 162) reports this species from coconut on Guam.

PALAU. BABELTHUAP: Ngiwal-Ngarad, Feb. 1938, Esaki, on *Nipa fruticans*; near Imeliik, Aug. 1953, Beardsley, on *Campnosperma brevipetiolata* leaves. KOROR: Takahashi (1936) reports this species from Koror on mango.

YAP. Takahashi (1941) records this species from Yap on *Campnosperma brevipetiolata.*

HOSTS: Described from material from coconut. Other recorded hosts include *Nipa* palm, mango, and *Campnosperma brevipetiolata.*

Ferris' 1955 redescription and figure of this species was based on material from near the type locality; the type material apparently was destroyed during World War II.

Genus **Pinnaspis** Cockerell

Pinnaspis Cockerell, 1892, Inst. Jamaica, Jour. **1**: 136.—Ferris and Rao, 1947, Microent. **12** (2): 25.

Type of genus: *Mytilaspis pandani* Comstock (= *Aspidiotus buxi* Bouché).

KEY TO KNOWN MICRONESIAN SPECIES OF PINNASPIS

1. Mesal margins of median lobes not closely appressed throughout their length, there being a slight but distinct gap between them; abdominal segment 5 normally without submarginal macroducts; second pygidial lobes large, apical portion of mesal lobule expanded and diagonally truncated; male scales unknown, apparently parthenogenetic ..... **buxi**

   Mesal margins of median lobes closely appressed nearly to apices, often appearing fused; abdominal segment 5 normally with 1 to 3 submarginal macroducts on each side; second pygidial lobes frequently smaller, or if large then apex of mesal lobule less strongly expanded and apically rounded; male scales normally present, white, carinate 2

2. Second pygidial lobes usually small, often much reduced and shorter than median lobes; crescent-shaped dorsal preanal scleroses of pygidium usually well developed; female scale white or grayish-white ..... **strachani**

   Second pygidial lobes usually larger, mesal lobule nearly or quite as long as median lobe; dorsal preanal scleroses of pygidium absent or only weakly developed; female scale brownish ..... **aspidistrae**

Ferris and Rao revised the genus (1947) and figured most of the known species.

140. **Pinnaspis aspidistrae** (Signoret).

Chionaspis aspidistrae Signoret, 1869, Soc. Ent. France, Ann. IV, **9**: 443.
Hemichionaspis aspidistrae: Cockerell, 1897, Am. Naturalist **31**: 592.
Pinnaspis aspidistrae: Lindinger, 1912, Die Schildlause, 79.—Ferris and

Rao, 1947, Microent. **12** (2) : 30, fig. 12.—Zimmerman, 1948, Insects of Hawaii **5** : 387, fig. 202.

DISTRIBUTION: Widespread (type locality: France ?).

PALAU. KOROR: Jan. 1953, Beardsley, on *Nephrolepis* fern.

PONAPE. Takahashi (1939) reports *P. aspidistrae* from Ponape on *Erythrina*.

HOSTS: Ferris and Rao list a number of hosts including *Aspidistra*, various ferns, several palms including coconut, and a few dicotyledonous plants.

141. Pinnaspis buxi (Bouché).

Aspidiotus buxi Bouché, 1851, Stett. Ent. Zeitung **12** : 111.

Mytilaspis buxi: Signoret, 1870, Soc. Ent. France, Ann. IV, **10** : 93.

Mytilaspis pandani Comstock, 1881, U.S. Dept. Agric., Rept. for 1880, 473.

Pinnaspis pandani: Cockerell, 1893, Ent. Mo. Mag. **29** : 157.

Pinnaspis buxi: Newstead, 1901, Monogr. Brit. Coccidae **1** : 207.—Ferris and Rao, 1947, Microent. **12** (2) : 32, fig. 13.—Zimmerman, Insects of Hawaii **5** : 390, fig. 202.

DISTRIBUTION: Widespread (type locality: Europe).

S. MARIANA IS. GUAM: Agricultural Farm, Jan. 1954, Liming, on *Philodendron* leaf.

PONAPE. Nanipil-Nanpohnmal, Jan. 1953, Gressitt, on *Pandanus* leaf.

HOSTS: Commonly found on leaves of *Pandanus*, and recorded throughout its range from a wide diversity of hosts, both monocots and dicots.

142. Pinnaspis strachani (Cooley).

Hemichionaspis minor strachani Cooley, 1899, Hatch Expt. Sta., Massachusetts Agric. Coll., Spec. Bull., 54.

Hemichionaspis marchali Cockerell, 1902, Soc. Ent. France, Bull. **71** : 82.

Hemichionaspis townsendi Cockerell, 1905, Davenport Acad. Sci., Proc. **10** : 135.

Hemichionaspis aspidistrae var. *gossypii* Newstead, 1908, Jour. Econ. Biology **3** : 37.

Pinnaspis minor: Takahashi, 1939, Tenthredo **2** (3) : 264.

Pinnaspis temporaria Ferris, 1942, Atlas Scale Ins. North America S-IV : 407.

Pinnaspis strachani: Ferris and Rao, 1947, Microent. **12** (2) : 39, figs. 19 and 19, A.—Zimmerman, 1948, Insects of Hawaii **5** : 300, fig. 203.

DISTRIBUTION: Widespread (type locality: West Africa).

S. MARIANA IS. ROTA: June 1946, Townes, on *Intsia bijuga*. GUAM:

Mt. Alutom, June 1946, Townes, on *Caesalpinia*; Talofofo, Dec. 1948. Maehler, on eggplant; Sept. 1953, Liming, on *Hibiscus*; Oct. 1953, Liming, on *Caesalpinia crista*, and on *Gossypium*; Yigo, Jan. 1954, Liming, on *Canavalia microcarpa* bark; in quarantine at Hawaii, May 1955, on betel palm.

PALAU. KOROR: Feb. 1954, Beardsley, on twigs of *Erythrina* sp.

YAP. YAP: Kolonia, Mar. 1949, Maehler, on *Solanum melongena.*

CAROLINE ATOLLS. PINGELAP: July 1949, Owen, on coconut and *Messerschmidia argentea.*

TRUK. WENA (Moen): Oct. 1952, Beardsley, on bark of *Hibiscus rosa-sinensis.*

PONAPE. Takahashi (1939) recorded this scale (as *P. minor*) from Ponape on eggplant.

WAKE. Feb. 1939, Bianchi, on *Euphorbia*; Nov. 1957, Krauss, on cotton twig; Nov. 1959, Ford, on stems of *Gossypium* sp., *Ipomoea grandiflora*, and eggplant.

MARSHALL IS. KWAJALEIN: In quarantine at Hawaii, Nov. 1946, Jones, on *Messerschmidia argentea*; May 1958, Gressitt, on *Hibiscus* bark; June 1958, Owen, on *Hibiscus* bark; July 1958, Clagg, on *Hibiscus* bark. NAMORIK: Namorik I., Sept. 1953, Beardsley, on twig of *Messerschmidia argentea.* EBON: Ebon I., Sept. 1953, Beardsley, on *Messerschmidia.*

GILBERT IS. TARAWA: Aug. 1956, Brown, on coconut. ONOTOA: Moul, on *Messerschmidia.*

OCEAN I. (Banaba). Dec. 1957, Krauss, on *Hibiscus* branch.

HOSTS: This is a common bark-infesting species on *Hibiscus*, *Messerschmidia*, cotton, eggplant, etc. Occasionally it has been taken on leaves of coconut.

Ferris and Rao (1947) call attention to the variability of certain morphological features of this species in the material which they studied. Considerable variation is exhibited also by Micronesian specimens which are at hand. The range of variation in such characters as the development of the second pygidial lobes and the dorsal preanal crescent-shaped scleroses of the pygidium is such that at times the separation of slide-mounted females of *P. strachani* from those of *P. aspidistrae* is a difficult matter. Perhaps the most consistent difference yet demonstrated between the two species is the color of the female scale—brown in *aspidistrae* and white or grayish white in *strachani.* In the Micronesian specimens at hand the median pygidial lobes are somewhat longer and broader in *strachani* than in *aspidistrae*, but as only two specimens of the latter species are available, it seems quite likely that this difference may be an apparent one resulting from the peculiarities of the small sample. McKenzie (1956: 150) states that the third pygidial lobes are clearly indicated in *strachani*, but at most

only slightly so in *aspidistrae*. Examination of the Micronesian material at hand does not confirm McKenzie's findings in this regard.

Genus **Pseudaulacaspis** MacGillivray

Pseudaulacaspis MacGillivray, 1921, The Coccidae, 305.—Ferris, 1937, Atlas Scale Ins. North America S-I : 108.
Saskiaspis Kuwana, 1926, Diaspine Coccidae of Japan **4** : 9.

Type of genus: *Diaspis pentagona* Targioni-Tozzetti.

143. Pseudaulacaspis pentagona (Targioni-Tozzetti).

Diaspis pentagona Targioni-Tozzetti, 1886, Riv. Bachicoltura **18** : 11.
Aulacaspis pentagona: Fernald, 1903, Cat. Coccidae of World, 234.
Pseudaulacaspis pentagona: MacGillivray, 1921, The Coccidae, 305.—Ferris, 1937, Atlas Scale Ins. North America S-I : 109.
Saskiaspis pentagona: Kuwana, 1926, Diaspine Coccidae of Japan **4** : 9, pls. 1, 4 a-h.

DISTRIBUTION: Widespread (type locality: Italy).

S. MARIANA IS. SAIPAN: Chalan Laulau, June 1946, Oakley, on cowpeas; June 1946, Oakley, on pepper; Garapan, June 1946, Oakley, on cassava; Civ. Ad. Area, Feb. 1949, Maehler, on cassava. GUAM: Mar. 1954, Peterson, on cassava.

PALAU. KOROR: July 1946, Oakley, on cassava; Jan. 1954, Beardsley, on bark of croton; Feb. 1954, Beardsley, on twigs of *Erythrina* sp. and on cassava stems.

CAROLINE ATOLLS. FARAULEP: Faraulep I., Feb. 1953, Beardsley, on *Plumeria*; Jan. 1964, Owen, on cassava stem.

TRUK. WENA (Moen): Feb. 1948, Maehler, on *Manihot esculenta*; Feb. 1954, Beardsley, on cassava and on breadfruit twigs.

HOSTS: This species has been reported from a long series of hosts. Breadfruit and cassava (*Manihot esculenta*) are plants of agricultural importance which are attacked by this scale in Micronesia. Cassava was often found heavily infested in Palau and Truk. Takahashi (1939, 1941) reported this scale from Saipan and Palau, on cassava.

Genus **Radionaspis** Ferris

Radiaspis Ferris, 1938, Atlas Scale Ins. North America S-II : 152 (preoccupied).
Radionaspis Ferris, 1942, Atlas Scale Ins. North America S-IV : 422.

Type of genus: *Leucaspis indica* Marlatt.

144. Radionaspis indica (Marlatt).

Leucaspis indica Marlatt, 1908, U.S. Bureau Ent., Tech. Ser., Bull **16** (2) : 26.
Suturaspis indica: MacGillivray, 1921, The Coccidae, 267.
Radiaspis indica: Ferris, 1938, Atlas Scale Ins. North America S-II : 153.
Radionaspis indica: Ferris, 1942, Atlas Scale Ins. North America S-IV : 422.

DISTRIBUTION: Florida (type locality), Puerto Rico, Hawaii, India, Caroline Is.

PALAU. KOROR: Aug. 1953, Beardsley, on bark of mango.

HOST: Known only from bark of mango (*Mangifera indica*).

The assignment of this peculiar pupillarial species to any of the currently recognized tribes of the Diaspidinae is open to question (see Brown and McKenzie, 1962 : 166), and its placement here with the Diaspidini is more a matter of convenience, following Ferris (1938 and 1942), than of conviction. The species appears to be bisexual, and it is possible that a study of males would help elucidate its relationship to other armored scales.

Genus **Unaspis** MacGillivray

Unaspis MacGillivray, 1921, The Coccidae, 308.—Ferris, 1937, Atlas Scale Ins. North America S-I : 128.
Prontaspis MacGillivray, 1921, The Coccidae, 311.

Type of genus: *Chionaspis acuminata* Green.

145. Unaspis citri (Comstock).

Chionaspis citri Comstock, 1883, Cornell Univ., Agric. Expt. Sta., Dept. Ent., Rept. **2** : 100.
Howardia citri: Berlese and Leonardi, 1898, Ann. di Agric. Rome II : 125.
Prontaspis citri: MacGillivray, 1921, The Coccidae, 311.
Unaspis citri: Ferris, 1937, Atlas Scale Ins. North America S-I : 129.

DISTRIBUTION: Widespread (type locality: Louisiana).

PONAPE. Palikir Valley, Jan. 1949, Ross, on *Citrus decumana*.

HOSTS: Various species of *Citrus*.

LITERATURE CITED*

BALACHOWSKY, A. S.
1942. Essai sur la classification des cochenilles (Homoptera-Coccoidea). Grignon Ecole Nat. Agric., Ann. III, **3**: 34–48, figs.
1956. Les Cochenilles du Continent Africain Noir, Vol. 1: Aspidiotini (pt. 1). Mus. Roy. Congo Belge, n.s., Ann. **3**: 1–142, pls.
1958. Les Cochenilles du Continent Africain Noir, Vol. II: Aspidiotini (pt. 2), Odonaspidini et Parlatorini. Mus. Roy. Congo Belge, Ann. **4**: 149–356, figs.
1957. Observation biologique et systematique sur la cochenille de l'ananas (Dysmicoccus brevipes Ckll.) a la Martinique. Rev. Path. Veg. Ent. Agric. France **36** (4): 189–197, figs.

BANKS, C. S.
1906. New Philippine Insects. Philippine Jour. Sci. **1**: 229–236, figs.

BEARDSLEY, J. W.
1955. Fluted scales and their biological control in United States administered Micronesia. Hawaiian Ent. Soc., Proc. **15** (3): 391–399.
1959. Notes and exhibitions. Hawaiian Ent. Soc., Proc. **17** (1): 10.
1959a. On the taxonomy of pineapple mealybugs in Hawaii, with a description of a previously unnamed species (Homoptera: Pseudococcidae). Hawaiian Ent. Soc., Proc. **17** (1): 29–37, figs.
1960. A preliminary study of the males of some Hawaiian mealybugs (Homoptera: Pseudococcidae). Hawaiian Ent. Soc., Proc. **17** (2): 199–243, figs.
1962. Descriptions and notes on male mealybugs (Homoptera: Pseudococcidae). Hawaiian Ent. Soc., Proc. **18** (1): 81–98, figs.
1965. Notes on the pineapple mealybug complex, with descriptions of two new species (Homoptera: Pseudococcidae). Hawaiian Ent. Soc., Proc. **19** (1): 55–68.

BETREM, J. G.
1940. A new Rhizoecus species. Treubia **17**: 267–270, figs.

BORCHSENIUS, N. S.
1949. Fauna of USSR. Homoptera, Pseudococcidae (in Russian). Akad. Nauk. Zool. Inst. (n.s. 38) **7**: 383 pp., figs.
1960. Notes on the Coccoidea of China. IX. Descriptions of some new genera and species of Margarodidae, Eriococcidae, and Pseudococcidae (Homoptera: Coccoidea) (in Russian with English summary). Rev. Ent. URSS **34** (4): 914–938, figs.

BROWN, S. W.
1959. Lecanoid chromosome behavior in three more families of the Coccoidea (Homoptera). Chromosoma **10**: 278–300, figs.

BROWN, S. W. and H. L. MCKENZIE
1962. Evolutionary patterns in the armored scale insects and their allies (Homoptera: Coccoidea: Diaspididae). Hilgardia **33** (4): 141–170A, figs.

COTTIER, W.
1936. A redescription of Pseudococcus cocotis Maskell, including a description of the male. Roy. Ent. Soc. London, Proc. (ser. B) **5**: 25–31, figs.

EZZAT, Y. M. and H. S. MCCONNELL
1956. A classification of the mealybug tribe Planococcini (Pseudococcidae, Homoptera). Univ. Maryland Agric. Expt. Sta., Bull. A-**84**: 108 pp., figs.

FERNALD, M. E.
1903. A catalogue of the Coccidae of the world. Massachusetts Agric. Expt. Sta., Sp. Bull. **88**: 360 pp.

*These references are to specialized papers on Coccoidea, not included in the Bibliography, volume 2, Insects of Micronesia series.

FERRIS, G. F.
1937. Atlas of the scale insects of North America, Ser. I, nos. 1–136, figs. Stanford University Press, California.
1938. Atlas of the scale insects of North America, Ser. II, nos. 1a, 2a, and 137–268, figs. Stanford University Press.
1938a. Contributions to the knowledge of the Coccoidea (Homoptera) VII. Microent. **3** (2) : 37–56, figs.
1941. Atlas of the scale insects of North America, Ser. III, nos. 2b and 269–384, figs. Stanford University Press.
1941a. The genus *Aspidiotus* (Homoptera: Coccoidea: Diaspididae). Microent. **6** (2): 33–69, figs.
1942. Atlas of the scale insects of North America, Ser. IV, nos. 2c, 385–448, figs. Stanford University Press.
1950. Report upon scale insects collected in China (Homoptera: Coccoidea) Part II. Microent. **15** (3) : 69–97, figs.
1950a. Atlas of the scale insects of North America, Ser. V [Vol. 5]. The Pseudococcidae (Pt. I), vii + 278 pp., figs. Stanford University Press.
1953. Atlas of the scale insects of North America, vol. 6. The Pseudococcidae (pt. II), vii + pp. 279–506, figs. Stanford University Press.
1955. Atlas of the scale insects of North America, vol. 7. Families Aclerdidae, Asterolecaniidae, Conchaspididae, Dactylopiidae, and Lacciferidae. iii + 233 pp., figs. Stanford University Press.
1955a. The genus *Phenacaspis* Cooley and Cockerell, part I (Insecta: Homoptera: Coccoidea). Microent. **20** (3) : 41–82, figs.
1956. The genus *Phenacaspis* Cooley and Cockerell, part II (Insecta: Homoptera: Coccoidea). Microent. **21** (2) : 67–83, figs.
1957. Notes on some little known genera of Coccoidea. Microent. **22** (3) : 59–79, figs.

FERRIS, G. F. and V. P. RAO
1947. The genus *Pinnaspis* Cockerell (Homoptera: Coccoidea: Diaspididae). Microent. **12** (2) : 25–58, figs.

GREEN, E. E.
1896–1922. The Coccidae of Ceylon. 1896, Part I, i–xi, 1–103, figs. 1899, Part II, xiii–xli, 105–169, figs. 1904, Part III, pp. 171–249, figs. 1909, Part IV, pp. 250–344, figs. 1922, Part V, pp. 345–472, figs.
1916. Notes on the Coccidae occurring in the Seychelles Islands, with descriptions of new species. Bull. Ent. Research **7** :193–196.

HALL, W. J.
1946. On the Ethiopian Diaspidini (Coccoidea). Roy. Ent. Soc. London Trans. **97**: 497–592, figs.
1954. Outbreaks and new records. F.A.O. Plant Protection Bull. **2** :44 .

HAMBLETON, E. J.
1946. Studies of hypogeic mealybugs. Rev. de Ent. **17** : 1–77, figs.

KUWANA, I.
1922. Studies of Japanese Monophlebinae. Contribution I. The genus *Warajicoccus*. [Japan] Dept. Agric. Com. Imp. Plant Quar. Sta., Bull. 1, 58 pp., figs.
1925. The diaspine Coccidae of Japan, II. The genus *Lepidosaphes*. [Japan] Dept. Finance, Imp. Plant Quar. Serv., Tech. Bull. **2** : 1–42, figs.
1925a. The diaspine Coccidae of Japan, III. The genus *Fiorinia*. [Japan] Dept. Finance, Imp. Plant Quar. Serv. Tech. Bull. **3** : 1–20, figs.

LAING, F.
1929. Report on Australian Coccidae. Bull. Ent. Research **20** : 15–37, figs.

MACGILLIVRAY, A. D.
1921. The Coccidae. viii + 502 pp. Scarab Co., Urbana, Illinois.

McKenzie, H. L.
1938. The genus *Aonidiella* (Homoptera: Coccoidea: Diaspididae). Microent. **3** (1): 1–36, figs.
1939. A revision of the genus *Chrysomphalus* and supplementary notes on the genus *Aonidiella* (Homoptera: Coccoidea: Diaspididae). Microent. **4** (2) : 51–77, figs.
1945. A revision of *Parlatoria* and closely allied genera. (Homoptera: Coccoidea: Diaspididae). Microent. **10** (2) : 47–121, figs.
1946. Supplementary notes on the genera *Aonidiella* and *Parlatoria* (Homoptera: Coccoidea: Diaspididae). Microent. **11** (2) : 29–36, figs.
1947. Miscellaneous diaspid scale studies. Part V. (Homoptera: Coccoidea: Diaspididae). Calif. Dept. Agric. Bull. **36** : 107–114, figs.
1956. The armored scale insects of California. Bul. Calif. Ins. Survey **5**, 209 pp., figs.
1960. Taxonomic study of California mealybugs with descriptions of new species (Homoptera: Coccoidea: Pseudococcidae). Hilgardia **29** (15) : 681–770, figs.
1962. Third taxonomic study of California mealybugs, including additional species from North and South America (Homoptera: Coccoidea: Pseudococcidae). Hilgardia **32** (14) : 637–688, figs.

Merrill, G. B.
1953. A revision of the scale-insects of Florida. State Plant Board Florida, Bull. **1**, 143 pp., figs.

Morrison, H.
1920. The nondiaspine Coccidae of the Philippine Islands, with descriptions of apparently new species. Philippine Jour. Sci. **17** : 147–202, figs.
1925. Classification of scale insects of the subfamily Ortheziinae. Jour. Agric. Research **30** : 97–154, figs.
1925a. Identity of the mealybug described as *Dactylopius calceolariae* Maskell. Jour. Agric. Research **31** : 485–500, figs.
1928. A classification of the higher groups and genera of the coccid family Margarodidae. U.S. Dept. Agric., Tech. Bull. **52** : 231 pp., figs.
1929. Some neotropical scale insects associated with ants. Ent. Soc. America, Ann. **22** : 33–60, figs.
1952. Classification of the Ortheziidae. Supplement to "Classification of scale insects of the subfamily Ortheziinae." U.S. Dept. Agric. Tech. Bull. **1052** : 80 pp., figs.

Morrison, H. and E. Morrison
1922. A redescription of the type species of the genera of Coccidae based on species originally described by Maskell. U.S. Nat. Mus., Proc. **60** (12) : 120 pp., figs.

Morrison, H. and A. V. Renk
1957. A selected bibliography of the Coccoidea. U.S. Dept. Agric., Misc. Pub. **734** : 222 pp.

Rao, V. P.
1950. Iceryine scale insects recorded from the Orient, Parts I and II. Indian Jour. Ent. **12** (1) : 39–66; and **12** (2) : 127–158, figs.

Rao, V. P. and G. F. Ferris
1952. The genus *Andaspis* MacGillivray (Insecta: Homoptera: Coccoidea). Microent. **17** (2) : 17–32, figs.

Robinson, E.
1917. Coccidae of the Philippine Islands. Philippine Jour. Sci. **12** : 1–47, figs.
1918. Descriptions and records of Philippine Coccidae. Philippine Jour. Sci. **13** : 145–147, figs.

Russell, L. M.
1941. A classification of the scale insects of the genus *Asterolecanium*. U.S. Dept. Agric., Misc. Pub. **424** : 319 pp., figs.

Sanders, J. G.
1906. Catalogue of recently described Coccidae. U.S. Dept. Agric., Bur. Ent., Tech. Ser. **12** : 1–18.

1909. Catalogue of recently described Coccidae—II. U.S. Dept. Agric., Bur. Ent., Tech. Ser. **16**: 33–60.

SANKARAN, T.
1962. The external characters of the post-larval stages of the wax scale, *Ceroplastes pseudoceriferus* Green (Hemiptera: Coccidae). Indian Jour. Ent. **24** (1): 1–18, figs.

SASSCER, E. R.
1911. Catalogue of recently described Coccidae—III. U.S. Dept. Agric., Bur. Ent., Tech. Ser. **16**: 61–74.
1912. Catalogue of recently described Coccidae—IV. U.S. Dept. Agric., Bur. Ent., Tech. Ser. **16**: 83–97.
1915. Catalogue of recently described Coccidae—V. Ent. Soc. Washington, Proc. **17**: 25–38.

SCOTT, C. L.
1952. The scale insect genus *Aulacaspis* in Eastern Asia (Homoptera: Coccoidea: Diaspididae). Microent. **17** (2): 33–60, figs.

STEINWEDEN, J. B.
1929. Basis for the generic classification of the coccoid family Coccidae. Ent. Soc. America, Ann. **22**: 197–245, figs.
1946. The identity of certain common American species of *Pulvinaria* (Homoptera: Coccoidea: Coccidae). Microent. **11** (1): 2–28, figs.

TAKAGI, S.
1960. A contribution to the knowledge of the Diaspidini of Japan (Homoptera: Coccoidea). Insecta Matsumurana **23** (2): 67–100, figs.
1960a. Two little-known Diaspididae from south-eastern Asia (Homoptera: Coccoidea). Akitu **9**: 77–79, figs.

TAKAHASHI, R.
1955. *Lecanium* of Japan (Homoptera: Coccidae). Shikoku Ent. Soc., Trans. **4**: 69–78, figs.
1955a. Key to the genera of Coccidae of Japan, with descriptions of two new genera and a little-known species (Homoptera). Insecta Matsumurana **19**: 23–28, figs.
1955b. *Pulvinaria* of Japan (Coccidae: Homoptera). Kontyu **23** (4): 148–154, figs.
1955c. *Lepidosaphes* of Japan. (Diaspididae: Coccoidea: Homoptera). Univ. Osaka Prefecture, Bull. (ser. B) **5**: 67–78, figs.
1957. Key to the genera of Pseudococcidae in Japan, with descriptions of three new genera and two new species (Homoptera). Univ. Osaka Prefecture, Bull. (ser. B) **7**: 1–8, fig.

WILKEY, R. F. and H. L. MCKENZIE
1961. Systematic status of the *Pseudococcus maritimus-malacearum* complex of mealybugs. Dept. Agric., State of Calif., Bull. **50** (4): 245–249, figs.

WILLIAMS, D. J.
1957. The genus *Semelaspidus* MacGillivray (Aspidiotini: Coccoidea: Hemiptera). Roy. Ent. Soc. London, Proc. (ser. B) **26**: 33–42, figs.
1958. The mealybugs (Pseudococcidae: Homoptera) described by W. M. Maskell, R. Newstead, T. D. A. Cockerell, and E. E. Green from the Ethiopian region. Brit. Mus. (Nat. Hist.), Ent. Bull. **6** (8): 205–236, figs.
1960. The Pseudococcidae (Coccoidea: Homoptera) of the Solomon Islands. Brit. Mus. (Nat. Hist.), Ent. Bull. **8** (10): 385–430, figs.
1962. The British Pseudococcidae (Homoptera: Coccoidea). Brit. Mus. (Nat. Hist.), Ent. Bull. **12** (1): 1–79, figs.

ZIMMERMAN, E. C.
1948. Homoptera: Sternorhyncha. Insects of Hawaii **5**: vii + 464 pp., figs. University of Hawaii Press, Honolulu.